Issue of
September, 1929
Vol. 5, No. 3

Aeronautics

For Sportsman, Business Man and Pilot

CONTENTS

From the Publisher's Quill 9
Panama Is Defenseless 11
By General William Mitchell
The Story of Vertical Flight 15
By Ernest W. Fair
A Tip to Hoy—or More Pilot Trouble 18
By Francis D. Walton
The Flying Movies 20
By Lt. Cdr. Frank W. Wead
In the Flood Light 23
The Great Resorts of Europe 24
Future Possibilities in Aircraft Engine Design 25
Airing Armament Secrets 29
By John Goldstrom
Aviation Stocks in Greater Favor 31
By B. C. Forbes and R. W. Schabacker
Flight Test Procedure 32
By Lt. Cdr. A. C. Miles, U. S. N.
They Tell Us— 36
High Flying 38
By Betty Huyler
Aerodynamics 44
By Alexander Klemin
Books of the Month 50
With the Industry 52
The Stout Airlines 54
By Charles K. Fewkes
The Monthly Financial Review 75
By J. Allen Grover
The Compressed Air Motor Assembly 78
By Bertram Pond
Classified Advertising 89
Directory 90
Index of Advertisers 98

"Aviation can grow only so fast as the demand for aerial carriers increases." — **Richard Rea Bennett,** *in Aviation, Its Commercial and Financial Aspects.*

Published Monthly by Aeronautical Publications, Inc., at 608 South Dearborn Street, Chicago, Illinois.
William B. Ziff, President
Harley W. Mitchell, Vice President
B. G. Davis, Secretary-Treasurer
Aeronautics Advertising Advisory Board: J. Don Alexander, C. H. Biddlecombe, Archibald Black, Stedman Hanks, P. G. Kemp, George Pynchon, Jr.

Edited by Harley W. Mitchell; R. Stuart Murray, Advertising Manager; Eastern Advertising Office, 551 Fifth Avenue, New York City. Subscription $2.50 per year; single copies, 25 cents; foreign postage $1.00 per year extra. All contributions paid for at regular rates, but the publishers cannot be responsible for the loss of any manuscripts or material submitted. Entered as second class matter, January 23, 1929, at the Post Office, Chicago, Illinois, under the Act of March 3, 1879. Copyright 1929, by Aeronautical Publications, Inc.

Member Audit Bureau of Circulations

The Most Quoted Aeronautical Publication

STABILITY
—*the unseen pilot, rides in every Command-Aire*

During a recent western tour, pilot flew this Command-Aire from San Diego to Los Angeles in one hour and thirty-eight minutes without once touching the stick. Command-Aire's model 5C3 powered with Curtiss Challenger 170 H. P. Motor

THE complete security you feel in a COMMAND-AIRE is due to positive, in-built, exclusive superiorities in the plane itself. You sense a subtle difference the moment you're in the air. The invariable stability of the ship gives you a serene feeling that a safe pilot is at the controls. AND THERE IS . . . *for stability holds the stick in every* COMMAND-AIRE.

The exclusive design of COMMAND-AIRE'S slotted ailerons make it the safest plane aloft . . . the ship that POSITIVELY CANNOT GO INTO A TAIL SPIN . . . the only plane over which the pilot has complete control at all speeds! Even should the engine stall, the pilot can safely land his COMMAND-AIRE.

COMMAND-AIRE flies unruffled through the severest test an airplane can meet . . . when the pilot leaves the cockpit and straddles the fuselage, while the plane continues its flight under perfect self-control. This is in no sense a stunt,

but a routine, everyday COMMAND-AIRE factory test.

This amazing balance and stability is achieved through the slotted joining of ailerons to the lower wing—one of 10 CARDINAL POINTS of structural superiority built into every COMMAND-AIRE. Air-minded moderns are looking for safety and stability in the planes they buy and fly . . . COMMAND-AIRE supplies both to a superlative degree. May we tell you how?

COMMAND-AIRE, INC.
Little Rock, Arkansas
General Distributors
CURTISS FLYING SERVICE, Inc.
27 West 57th Street, New York

COMMAND-AIRE

№53

THE PLANE FOR WIDER SALES

From the Publisher's Quill

"Simple Duty Hath No Place for Fear"—John G. Whittier

Dayton Swings Into Action

THE Dayton Daily News in spread-eagle headlines announces that Dayton is for a national air Academy.

According to the News "A committee of Dayton's foremost citizens" headed by Fred. Patterson, President of the Dayton Airport, has taken the bull by the horns and is actively campaigning to bring this great national project to Dayton, declaring that "primarily it has been designed as that needed link which shall associate Dayton in the mind of the rest of the world, not only as a center of military aeronautics, but of the commercial trend as well."

AERONAUTICS has previously recommended another location for this necessary addition to our American institutions. Our impelling reason was a desire to provide a focal point where the idea might find sanctuary against its fell enemies of indifference and inertia. We felt that with an active and aggressive commonwealth purposefully behind this project, with a natural desire to bring it within its own borders, it would not die in its period of inculcation. This and reasons of public policy, which seemed good, actuated our selection of Wichita, Kansas, as the proposed seat of this great new Academy.

As far as we are concerned however, we are gripped by no fervent desire of location. All we seek is the fact and establishment, and may the city have it that is smart enough to get it.

Our position is simply one of sincere willingness to back any town, village or center, willing to man the guns and build this hope into achievement.

Meanwhile we are greeted with a veritable flood of communications, a few claiming that we are crazy and should be locked up for the common good. The vast majority agree wholeheartedly with our contentions, pilots, war flyers, manufacturers, and newspapers.

We have reason to believe that the flood of sound opinion is rising.

America is destined to have a unified air service and a great National Military Academy of the Air.

If those whose soul is in this program will put their honest and patriotic desires above inertia and fear, all hell can't stop it from becoming a fact in the near future.

Considered alone from the background of National subsidy with the necessities of co-ordinated military defense eliminated from the picture, how can aviation, dismembered between four or five governmental bureaus, seek funds for its proper development? Always a tail on some other kite, it is certain to struggle along without great National assistance, making its true progress on the back of commercial genius.

It is our belief that only in centralization can progressive and aggressive organization be resident. Aeronautics, to contend with other bureaus continually seeking and requiring support, needs the type of assistance—among other things—which will enable it to maintain a lobby for the purposes of its advancement.

As an example, it is a curious state of affairs when a great enterprise, sadly in need of assistance itself, is compelled to pay toll to the support of another, older and well entrenched.

This is exactly what happens every time a gallon of gasoline is burned in flight. Gasoline taxes, ranging between two cents in New York to six cents in South Carolina, add to the burden of this infant industry and are in effect a road tax.

It is stretching the imagination when a babe in need of all available aid itself is forced to pay for the upkeep of public roads and the further glory of the motor car and bus manufactories.

America has the possibility of incomparable pre-eminence of the skyways. With it, a greater grip than ever on commercial supremacy, and a safety from attack that no nation has ever enjoyed in the aeons of time. It cannot be too often repeated: this elysium can only come from centralized effort, co-ordinated command and unified purpose.

A Standard of Comparison Needed

A difficult situation now exists in reference to standards of comparison for performance, both so engines and craft themselves may be properly judged and honest claims made safe, and in relation to air races, endurance contests, etc.

Trustworthy and fairminded builders find themselves at the mercy of competitors, who assert wild values for their products, usually confusing the mind of the purchaser, who in this era is more often than not unacquainted with the basic engineering of the craft he buys.

Is air worthiness and cruising speed identical with a Kansas stem winder on your tail, in the dead calm of the doldrums, or in a fresh wind? What standards of conditions exist to govern standards of performance, so that the honest manufacturer gets an even break in the shuffle?

How on earth can confidence be built with the purchasing public where the standards of values are as elastic as a rubber band? It is somewhere near time that the industry took cognizance of this matter and put an end to some of the droll claims made.

AERONAUTICS itself has been so leary of performance claims due to this total lack of measuring rule, that for a long time we refused absolutely to print any claims of performance whatsoever.

The same thing holds true in the matter of races, endurance tests, etc.

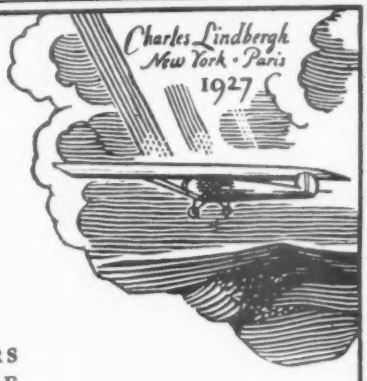
If these have any value at all, it exists as showing the competitive worthiness of the different machines, engines, and accessories.

If, for instance, an endurance test at Cleveland working through fog and propeller smashing hail is to be subject to the same conditions as one held in the gentle calm of South California, then the whole idea is no better than a dance marathon, and should be prohibited by law. Its scientific and commercial values as far as standard comparisons are concerned are as negligible as a humming bird's whiskers.

Restrictive Legislation

A member of Congress, who has given serious thought to the possible need of protective legislation in the aeronautical industry, stated in a letter asking the opinion of the writer of this editorial:

(Continued on page 88)



WRIGHT AERO

TEN IMPORTANT FACTORS
IN AN AIRPLANE ENGINE

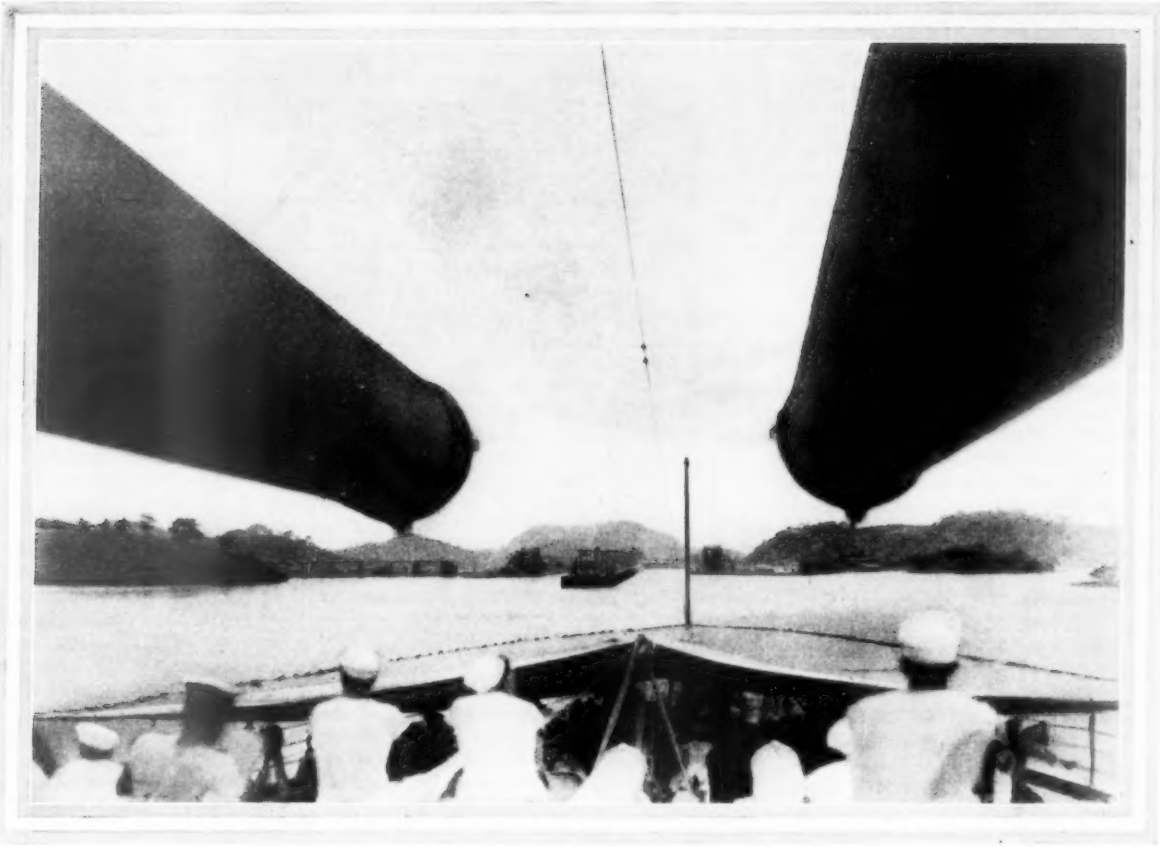
No1 . . RELIABILITY

There is no more important requirement in an airplane engine than *reliability*. The whole basis of satisfactory flying, whether by the private owner of one airplane or by the international operator of a large fleet, is the reliability of the engine used.

Wright engines have *proved* this reliability to a greater extent than any other aviation engine in the world. Their ability to continue running for more than 150 hours in the "Question Mark" and over 172 hours—*more than 7 days*—in the "Fort Worth," is a strikingly conclusive demonstration that Wright engines have this all-important feature—*reliability*.

WRIGHT

AERONAUTICAL CORPORATION
PATERSON, NEW JERSEY
U. S. A.



Panama Is Defenseless

By General William Mitchell

Former Commander Air Forces, A. E. F., and Director, Military Aeronautics, U. S. A.

WE have been taught by the old naval strategists that the Panama Canal is the most important single element for the defense of the United States, because, possessed of the Canal, we may transfer our war fleets from the Atlantic to the Pacific, or from the Pacific to the Atlantic, thereby combining all our sea power against an adversary in either ocean. If we were menaced on both our coasts at the same time, we could mass our whole sea power against the most dangerous of our foes, whereas they, in order to combine their naval strength, would have to make a trip clear around Cape Horn at the southern extremity of South America, a voyage of many thousand miles.

Air power, however, has decidedly changed and modified these conditions. A surface fleet is no longer vital to defense. If all of our surface battleships and attendant craft attempted to sail across the Pacific Ocean and attack Japan, Japanese aircraft would have no difficulty whatever in locating and sinking them, hundreds and even thousands of miles away from the shores of their island empire. Similarly, if a fleet attempted to cross the Atlantic they would be destroyed by aircraft long before they reached the shores of Europe.

Naval battles have always taken place comparatively close to shore as the defending ships stayed near their magazines and depots. If fleets ever do act again, the same conditions will apply, which will give aircraft an added advantage as they will not have to fly so far over the sea.

The Panama Canal is and will continue to be of prime importance as far as commerce is concerned, but in war it is not a particularly great asset to us, for the reason that we shall strike directly at an adversary with our aircraft along lines that give us the shortest distance; to Europe, either by the great circle route or via Newfoundland and Greenland, and to Asia by Alaska, Siberia or the Aleutian Islands. These are the decisive areas for future military operations between America, Europe and Asia. There will be no great operations in the southern hemisphere or much farther south than the 30th parallel of north latitude, because the great centers of population, industry, resources and power lie north of this line.

The point of the whole matter is that air power has superseded sea power both as a means of controlling the sea and defending the coast or interior of the country. Now a whole country must be considered as a coast as the air covers it evenly everywhere. Air power is the offensive arm par excellence of a nation.

The Panama Canal may easily be put out of commission and rendered useless by the attack of aircraft. There are islands belonging to foreign nations, such as the Bahamas, Jamaica, the Windward Islands and points off South America, that are within easy aircraft range of

the Panama Canal. Large aircraft bombs dropped in the locks, particularly when a ship is being sent through, will break things up so that it will be impossible to repair the masses of twisted iron, masonry and lock gates for a long time. The earth along the Culebra Cut could easily be precipitated into the canal by aircraft bombs. Probably a movement of the whole hillside into the canal could be started. If the Gatun Spillway were destroyed by aircraft, it would lower the level of the water in the canal to such an extent that it could not be used for a period of many months.

THE PANAMA CANAL APPROACHES
Most of the surrounding islands are owned by foreign countries, so the defense by surface fleets is folly

Today all military strategists know the vulnerable places in the Panama Canal. I remember, before the European War, when I was on the General Staff, that the Germans had one officer detailed to specialize on everything concerning the Panama Canal. He probably knew more about it than any other one person in the world. Other nations have done the same thing, so there is nothing hidden or secret about how it could be attacked and destroyed. The principal means of doing so today is through the air. The weapons that have been used in the past from aircraft are only pigmy implements compared to what will be used in the future. This is the day of the high explosive and the power of explosives is constantly growing in its relation to size and weight.

Each year our Navy goes to Panama to have maneuvers and tea parties. It is pleasant down there in the winter, the sky is clear, there is no cold and fog such as in the north, and very comfortable maneuvers can be held. The Navy proclaims that foreign nations might bring airplane carriers into the Caribbean Sea which would launch their aircraft and destroy the Canal, or hostile battleships could be brought in close to shore and shoot up the bushes and put ashore landing parties much in the same fashion as in the days of Pizarro, Sir Francis Drake or the pirates that operated on the Spanish Main. Therefore, they say, we need a great navy to defend the Canal.

To distribute such propaganda throughout the United States, in an effort to influence the minds of the people, is ridiculous. It is a decided insult to the average intelligence, even that of a child.

Take a map of the Caribbean Sea. Observe that from Florida to the coast of South America there is a continuous string of islands. First comes Cuba, ninety miles from the coast of Florida; then Haiti and San Domingo with a gap of about seventy miles, then Porto Rico, after another gap of the same distance. Then a succession of small islands, to the Virgin Islands, with gaps of from twenty to forty miles, then the Windward Islands, owned by France and Great Britain, to the very coast of South America. These islands can be plainly distinguished one from another when an airplane is four or five thousand feet over them. They are all within easy flying distance of the Panama Canal, and England owns the Island of Jamaica which is a bare five hours' flight from the Canal.

When we acquired the Virgin Islands by purchase from Denmark, we relinquished all our rights of discovery and proprietorship to Grantland which lies in the Arctic Ocean abreast of the northern part of Greenland. Grantland is not covered by an ice cap as is Greenland. In the summer, flowers bloom there and streams run through it filled with trout and other fish. Land animals abound. It is a perfectly habitable country. Due to the moronic influence of naval strategists, we actually gave this place up. It is one of the most important situations in the world for an air base, because it is almost equidistant from the centers of population in Europe, Asia and America. This land could be used all the year round as an air base and as a point on a commercial airway between Europe, Asia and America. It has much more strategic value for national defense than the Virgin Islands; in fact, Grantland is more important strategically in time of war than the Panama Canal.

Our first great flight across the Caribbean Sea was made by Lt. Charles Austin, one of the ablest men we ever had in the American Air Service. He took an ordinary old DH airplane with wooden propeller, the ordinary magnetic compass and other instruments which we used during the war, put in extra gas tanks and started to fly from Panama to the United States by way of Jamaica and Cuba. When just off Jamaica, he ran into a series of thunderstorms and the rain was so heavy that it chewed up his propeller. He was forced to turn around and fly straight back to the airdrome at Panama, having completed a round trip of about 1,000 miles. Considering the equipment used, I believe his flight was one of the greatest ever made. If he had had a modern metal propeller, he probably could have completed his trip.

Several flights have been made along the islands from Florida to South America, by way of Cuba, San Domingo, Porto Rico and the Windward Islands. This is an easy route to follow.

Three or four airplanes assigned to an aerial patrol to watch for ships coming through the gaps between these islands could report their presence many hours before they even approached this barrier. These airplanes would be patrolling the air a thousand miles out in the Atlantic, or if we wished to use dirigibles as airplane carriers, we could push them clear over to the coast of Europe and Africa.

The speed of a fleet cannot be over twenty to twenty-five miles an hour. The cruising speed of a modern air force is 150 miles an hour, or six times the fastest speed that a fleet on the water is capable of. Within twenty-four hours, allowing the fleet a speed of 25 miles an hour, it could cover only 600 miles.

XUM

Usually it would cover about half that distance. In twenty-four hours, the air force, travelling at 150 miles an hour, could cover 3,600 miles; or an air force would be able to go in four hours the distance that a fleet could make in one day.

No matter whether it is daylight or dark, a surface fleet cannot be concealed. They are almost as easily picked up at night as in the daytime, and can be more easily approached by aircraft without detection. In the tropics, they invariably leave a long phosphorescent wake behind, which also helps to give them away.

As far as attacking a fleet from the air is concerned, it can be accomplished with the greatest ease. Nothing on a ship can stop it. Anti-aircraft fire is practically valueless, for the reason that guns have no point in the air on which they can check their fire or range. On the ground, the fire from a gun can be checked on a church steeple, or tree on top of a hill, or a field, or the bend of a river. On the sea, fire can be adjusted by the splash of the projectile when it hits the water. There are none of these marks in the air. Aircraft are moving so fast and changing altitude so rapidly that it is a very difficult matter to hit them. In the European war, in spite of the great development of anti-aircraft artillery and machine guns, we lost only about 1/10 of 1% of our airplanes due to gunfire from the ground. That loss was really due to the fact that we had to act very close to the ground and were mixed up in the fire of all sorts of weapons, such as machine guns, cannon, and rifles in the hands of the infantry. Since the war, there has been no decided improvement in anti-aircraft guns or the equipment for attacking airplanes from the ground. The army issues propaganda to make the people believe that guns are able to defend a city against aircraft, but this cannot be done.

Many of you may have an idea that it is easy to hit an airplane. Go out and take a garden hose and see if you can hit a butterfly with the stream, as he flies around your garden; or take a 22 rifle and shoot at a sparrow as he wings his way about. Of course, a mistake sometimes occurs and an airplane is hit and brought down, but this happens quite rarely. When airplanes are making an attack, if there is any likelihood of their incurring serious opposition from the ground, a demonstration is always made so as to distract the attention of the defenders from the place where the main attack is to be delivered.

Airplanes have gained decidedly over any means of defense from the ground, because now they can be made practically noiseless, can go to almost twice the altitude they could during the war, and move at twice the speed. They can be made very difficult to see. If there is sunlight, we always attack directly down the rays of the sun and it is almost impossible for people on the water or ground to see the planes accurately. Picture to yourself what an attack on a fleet by aircraft would mean. The fleet steams along with its submarines and destroyers pushed out to the front to report anything they see on the surface of the water. Next come the cruisers backing up the destroyers. Behind them are the aircraft carriers which are supposed to put airplanes into the air to act as the "Eyes of the Fleet." Behind them are the line ships, battleships as they are called, steaming along in single column, a couple of hundred yards apart, covering the sea with their smoke and throwing up a great white bow wave that can be seen from the air farther than the ship itself.

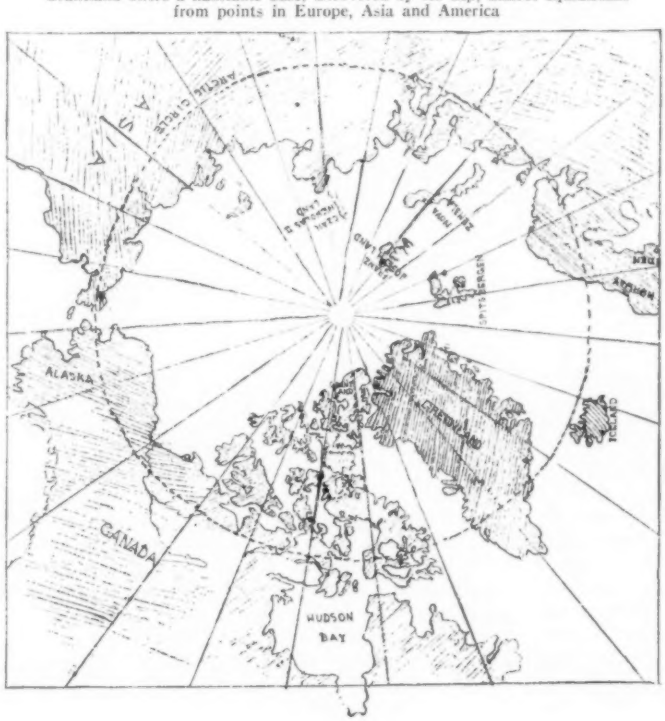
The whole fleet is able to carry a maximum of two hundred airplanes, we may say. These have to be of inferior size, speed and armament on account of having to land on the restricted space available on the decks of vessels. They can only keep a few airplanes in the air at one time, possibly thirty or forty as a maximum. These must be kept up day and night if they are to cover the fleet. With the average weather encountered at sea, it is practically impossible for them to do even this.

An air force acting from land bases may contain one, two or three thousand planes. The main attack would be preceded by pursuit planes capable of flying 300 miles an hour and equipped with eight or ten guns of various calibres, possibly also some small explosive and gas bombs. It takes only a small bomb to sink or destroy a cruiser. Whatever poor aircraft a fleet had would be immediately smothered under these conditions and shot down into the water. The attack by the air force would then be made from every direction of the compass clear around the fleet. Among the weapons used would be water torpedoes fired at a distance of two or three miles from the fleet. These torpedoes have a magnetic attachment which, when they near a ship, draws them right into the bottom of the vessel, where it is weakest. Air torpedoes may be launched from long distances, ten, fifteen, twenty or even one hundred miles, and guided right into the fleet by radio. Gliding bombs have wings, and when dropped, fall straight until they gather sufficient speed to be held up, then are guided toward their objective by a gyroscopic control on their rudders.

Another detachment of airplanes, flying at any height desired, up to 35,000 feet, could launch dropped bombs of any weight, from two thousand to six thousand pounds. If these exploded under water, at a depth of 80 or 90 feet, they probably would put out of commission a battleship one or two hundred yards off.

Under these conditions, what possible chance has any fleet? We have experimented with all of these things so that we are sure of what we are talking about. During the air bombardment exercises of 1921 I remember hearing some of the sailors talk to our airmen after they had seen the great German battleship, "Ostfriesland,"

THE SHORTEST LINE TO EUROPE
Grantland offers a habitable base, uncovered by ice cap, almost equidistant from points in Europe, Asia and America



sunk. "The Navy is a fine place in time of peace," they said. "We have nice places to sleep, we get the best of food and travel all over the world; but let me tell you, we'll never be in it if we have war." Our airmen asked them what would happen if they had war, and were attacked by aircraft. A sailor responded, "We would all get our life preservers and jump overboard. The captain would have to stay with his ship. He would get all the torpedo fuel on board (which is clear alcohol), go up in the conning tower, lock himself in and wait for the vessel to go down." This is what would happen, if any nation were so blind to modern warfare as to send a fleet out to sea.

A very few airplanes circling the fleet could drop gas bombs to the surface of the water, which would either kill everybody on board or make it impossible for the ships to operate.

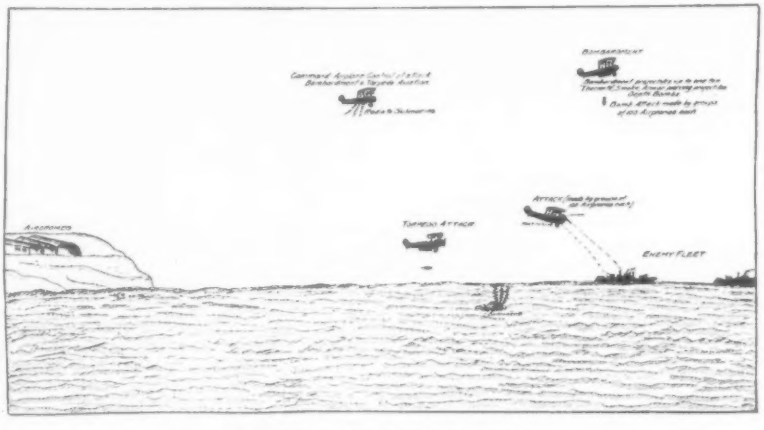
The first time I tried gas against surface vessels was during the bombing of the battleship "Alabama," anchored off Tangier Island shoals in Chesapeake Bay. We dropped a couple of 25 pound tear gas bombs on her, filled with half strength gas, merely to show how the gas would permeate the whole vessel. We boarded the ship about five minutes after these bombs had been dropped. All of us had gas masks, but none of us put them on before we reached the deck. Then instantly on they went. The gas penetrated every part of the vessel, clear down to the bottom. It stayed in the officers' clothing to such an extent that in the evening at dinner, those waiting on the table began to cry from the effects of this gas.

If the ship had been in commission with a crew on board, all her ventilators which suck in air would have taken up the gas and it would have been distributed over the vessel much more quickly than it was diffused by gravity. Even if the crew had gas masks and the ventilators were also masked, this would not stop a heavy concentration caused by one large gas bomb, for example, phosgene or mustard gas. You don't hear the Navy talking about these things much, because they don't like to think of them. Gas used from an airplane against these steel coffins would be quickly decisive.

Think what the cost of a fleet is. Say it contains sixteen battleships; figure that each battleship stands the country around $100,000,000 with its accessories, that is, its cruisers, torpedo boats, destroyers and aircraft. (As a matter of fact, it would be a great deal more than this.) This amount would pay for the construction and maintenance of 80,000 airplanes; and this sum does not include the navy yards, industrial plants and organization which a modern Navy needs. We have about $2,000,000,000 invested in Navy Yards in the United States alone. Wherever a navy goes, it is tied to its bases, and thus has become so expensive and so cumbersome that it is just dying of its own weight, both financially and physically.

Aircraft are able to establish bases with comparative ease and with great rapidity. An ordinary flat open field is all that is necessary for an airdrome. If small flat fields cannot be found, almost any location on the ground with a few hundred feet runway may be employed and arresting gear such as used on airplane carriers may be installed on the ground, so as to make the planes land in a very small space.

Aircraft can select these places from the air without any preliminary reconnaissance or inspection from the land itself. I used to practice this frequently, both in winter and summer, so as to accustom my men to maneuvers of this kind. We would go to the Allegheny Mountains, because this section is one of the roughest parts of the United States. I would give the commander of the airplane group following me a signal to stand by until I landed, then to bring his group down on a panel that I would stretch on the ground. Of the many times we did this, I never broke up an airplane of my own and rarely of any of those following me.



FUNCTION OF AIR SERVICE IN ATTACK
Each airplane represents one or more groups of one hundred planes, attacking with water and air torpedoes, gliding and dropped bombs, cannon and machine guns

Just at the conclusion of our bombing experiments in 1921, the great strikes in the West Virginia coal regions became so serious that the Federal government declared a state of martial law there and ordered troops to Charleston, West Virginia, the capital. We received orders to send two squadrons of airplanes to the same place. I immediately flew there with my aide, Capt. Streett, and selected a field below Charleston and landed. Then by telegraph I ordered the squadrons to come to that place from Langley Field, Virginia, which they did with great rapidity. These two squadrons of fifty airplanes consisted of two-seaters equipped for attack purposes with bombs and machine guns. Their equipment was carried in a provisional air train organized from bombing airplanes. The bombers carried a cargo of one ton each of ammunition or small bombs, food, camp equipment, and everything else necessary. Preceding the two squadrons in transport airplanes were the flight surgeons and complete medical staff with hospital equipment and supplies. The whole unit was ready to operate the minute it landed there. It took four times as long for troops to get there on railroad trains.

This opened the eyes of a good many people in this country to the possibilities of air power. Here were the same airplanes that had been flying out over the ocean for hundreds of miles and they immediately turned around when ordered and flew into some of the roughest country in America, and used an ordinary field for landing that had not been prepared in any way.

I have established winter bases in a similar manner, landing in the deep snow with a plane equipped with skis, followed by the airplanes of the squadron and transport airplanes carrying supplies.

Airplanes can supply themselves through the air with practically everything necessary, even machine tools for making repairs and mechanics to operate them. Airships undoubtedly will be used as a means of supply in the future and an air force will be able to pick up and move to practically any part of the world, fighting its way as it goes and if strong enough, will be able to ob-

(Continued on page 92)

The Story of Vertical Flight

THE KARMAN HELICOPTER
A successful helicopter using two opposed propellers operated by three engines through gearing

By Ernest W. Fair

IF ever a subject has created so many mistaken impressions that its real self has been overshadowed by them the helicopter is that one. Newspaper stories in particular have been overemphatic in their treatment of the machine and have led thousands of readers to believe that it possesses certain qualities with which no earthly machine could be practical. A news clipping with illustrations is before the writer even now describing the new helicopter that the British Air Ministry is bringing out. A picture of Juan de Cierva's autogiro is given together with pictures showing it rising vertically from a dead stop. There are hundreds of readers who know that the autogiro does not rise vertically from a dead stop but there are undoubtedly thousands who have a muddled conception not only of De Cierva's autogiro but of helicopters and vertical flight in general.

To begin with, no machine has as yet been developed that will rise vertically from a dead stop and at the same time prove practical and safe. Past work and present work have done much to perfect the helicopter but there is no existing true helicopter that will carry a useful load or that will descend safely should the motor or motors be stilled.

Before proceeding to discuss helicopters proper it might be well to speak a little further of De Cierva's near-helicopter, the autogiro.

In the autogiro the fixed supporting surfaces of the normal airplane are replaced by a freely rotating windmill or rotor mounted on a nearly fixed axis. This windmill, it will be noted, gives lifting service but does not flap, as many suppose, to give the plane vertical flight. The windmill is not connected with any motor but revolves freely. Its principal use consists in aiding the machine to hover and descend but while it can enable the autogiro to hover over a definite spot and descend vertically it cannot lift the autogiro vertically.

The plane has an ordinary motor driven propeller and is in fact much like any other airplane except for its tiny stubby wings and the windmill. The pilot starts the regular propeller and sends the plane forward along the ground. The rotor begins to turn by the action of the slipstream coming back from the propeller. Then it begins acting upon helicopter principles as will be explained shortly. The autogiro has a rate of climb of 400 feet per minute and a minimum speed of 27 miles per hour. It requires about 200 yards to take off in starting from 50 r.p.m. on rotor in still air.

With the clear conception of the autogiro's principles in mind let us proceed to the true helicopter itself. First, perhaps, a brief discussion of helicopter flight principles may prove interesting.

What is a helicopter? A helicopter may be defined as any self-powered aircraft that will rise and descend vertically from one fixed spot without any run across the ground for take-off or landing. By vertically, we of course mean in a straight line from the earth toward the zenith or in as near a straight line as possible.

It has been found that a helicopter can rise in a straight line much better than along an angle of inclination. This can be explained because of the resistance that the cumbersome machine gives in horizontal flight of any nature and since an inclined angle would entail some horizontal flight, all experimentation along this line has been abandoned.

How does a helicopter rise? There have been many answers to that question but only one of them is correct. Development of helicopters up to the present time has been made solely through the use of propellers which give a vertical thrust. There is little reason to look for much change in this principle either. The perfection of the helicopter will come about with the perfection of lifting propellers.

We consider the air in strata, of course. Consider, then, the helicopter, with its spinning propellers, eating their way upward from one strata to another of air, acting somewhat in the nature of a bit boring into a board.

To put it a little more scientifically, let us consider the Froude momentum theory which applies to the lift of the propellers used in giving ascent and descent to an helicopter. This theory, in as plain words as it is possible to state it, is that the air above a hovering airscrew starts from rest, approaches it with a Velocity V_1 as shown in the accompanying Figure 1, in a stream equal in area to that of the circular disk swept out by the propeller blades, and below the airscrew passes on with a greater Velocity V_2 in a contracted stream as shown in the same drawing. The thrust power ratio increases as the velocity of the air driven through the propeller decreases. Also, the greater the diameter and disk area, the less the air velocity and the greater the value of thrust power.

This briefly is the Froude momentum theory which explains the lift of the helicopter. The accompanying diagrams explain the passage of the air stream more clearly. Figure 2 represents the theory as applied to an airbrake or vertical descent on the part of the helicopter. This applies when the propeller or

propellers of the helicopter have been reversed and are rotating in the opposite direction. The entire lift of the helicopter is thus secured through this ro-

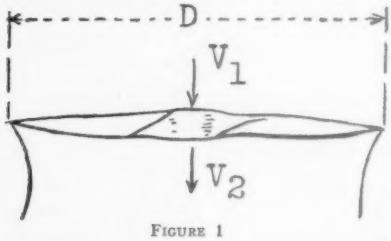


FIGURE 1

tating of the blades and forcing the air downward as explained in the theory and not by any sort of flapping action of wings or propellers. Helicopters are often confused with ornithopters (none of which have ever proven of any value) which secure ascent through a flapping action of their wings. There are no wing surfaces on the helicopter—all lift is secured by the thrust of the propellers. Any wing surface would only give added resistance of such a nature that the thrust of the helicopter blades might not be of enough power to overcome the added resistance. Herein lies one of the reasons for the failure of the helicopter to date.

The helicopter, let it be understood, is not a failure. It has been up to the present time a failure only in the sense that it has been unable to carry sufficient weight to make it practical and that it has proved erratic and unsafe in flight.

Wings would prove valuable in horizontal flight but detrimental in upward

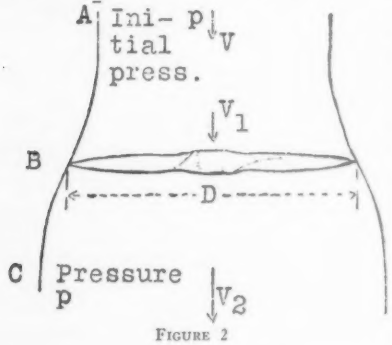


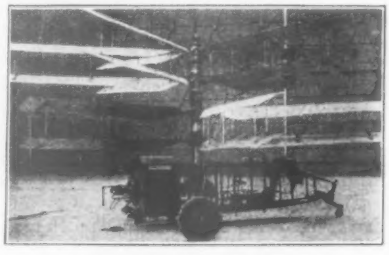
FIGURE 2

flight. Thus we have one good counteracting the other. Some method must be used to give the helicopter sustension in forward flight. The rotating blades can do their share but to give it sustension of practical nature is impossible with their use as yet. The development of some new propeller will meet that situation.

Perfected helicopters to date have been unable to carry much more weight than that of the pilot himself because of the lost thrust power ratio. This cannot be overcome by increasing propeller areas or lengths. For a helicopter airscrew to be of the most practical use the diameter must be as small as possible in order to keep down gear reduction ratios and centrifugal force.

The airscrew itself must do something more than provide lift. It has to secure a reasonable ceiling and, what is much more important, a reasonable rate of climb also.

The two-bladed, Hispano-Suiza powered, Pescara helicopter, a French machine which we shall describe shortly, holds the record for flight with 2,414 feet made on April 18, 1924 at Issy-les-Moulineaux with the motor developing 180 horsepower. This is, perhaps, a reasonable enough height when all factors are considered, but it is scarcely adequate for a practical, useful flying machine.



THE PESCARA HELICOPTER

Another of the objectionable features of the helicopter is its lack of safety. Lift is provided by the propeller thrust above described and sustension comes from the same source. Thus, when something happens to any of the mechanism parts, and there have been far too many such things in experimental helicopters so far, all sustension is lost and the helicopter drops to the earth like a great rock. No explanation of this effect is necessary. With the dead weight of the helicopter deprived of its lift and sustension we have nothing more than a great mass of machinery which will drop to earth immediately, causing disaster.

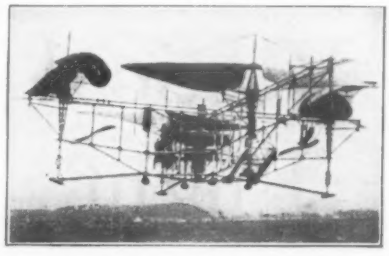
Wings might be used to stop this but this has proved impractical because the resistance of these wings practically neutralizes all thrust obtained from the airscrews. Thus, this great danger must be overcome before they can be made practical.

Helicopters have very little speed. There are many factors that tend to limit the speed as, for instance, the necessity for providing for safety of the structure and the character of the balancing and shock absorbing mechanism of the machine.

In order to make the helicopter problem clearer, let us see what Prof. Alexander Klemin, head of the Guggenheim School of Aeronautics and undoubtedly the leading authority in America on aerodynamics, has to say about these matters.

Here are the requirements that Professor Klemin has listed for the successful helicopter:

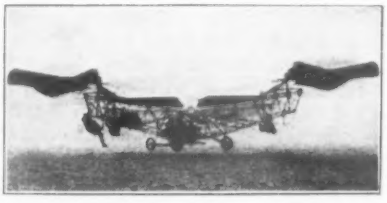
1. It must climb vertically with a moderate degree of useful load.



THE OEHMICHEN MODEL

2. It must attain a reasonable ceiling.
3. It must achieve vertical descent with engines in action.
4. It must achieve safe descent on a steep path with dead engines.
5. It must have a reasonable horizontal speed.
6. It must be fairly stable and completely controllable.

Before going further let us consider some of the machines already developed. The Berliner helicopter is one of the most interesting for it embodies many airplane characteristics. Its body consists of a fuselage with little deviation from that of the standard aircraft, much like the old Sopwith Camel of war days, in fact. There are three wing surfaces. In other words, the machine is a triplane, with each wing somewhat longer and with slightly greater span than the one above it. The wings are connected with struts and wires of the conventional airplane type. On the forward and rear section of each side of the middle wing of the triplane is a series of control ailerons which give balance to the plane itself. They are directly beneath the diameter of the arc swept by a propeller blade connected with the engine in the nose of the plane. There are



DE BOTHEZAT'S MACHINE

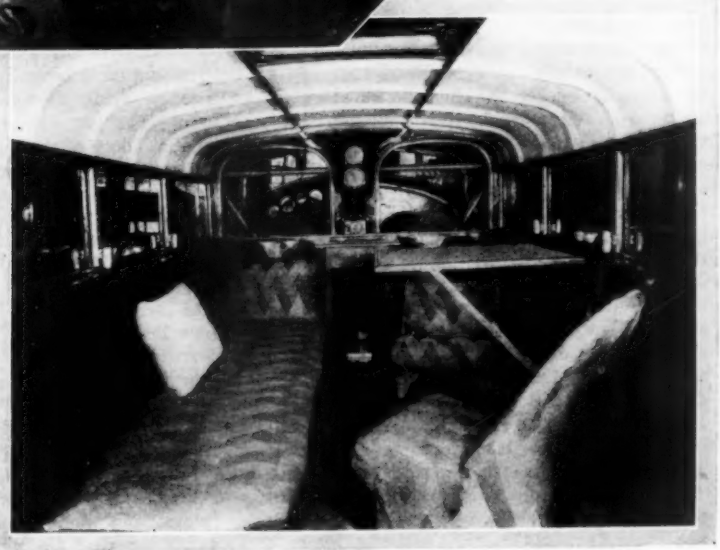
three of these propellers, one on each wing and one near the tail atop the fuselage, all controllable from the center cockpit of the plane. The tail of the

(Continued on page 67)

Modern Interiors

A bridge party in the air aboard the Rapid City (S. D.) Airline's newest ship, the "Wamblee Chanko"

Interior view of the Keystone twenty-passenger transport "Patrician." The pilots' compartment can be seen forward



Upholstery designed by Adolphe Grivin in a jig saw pattern of cotton and rayon. (Photo by courtesy of the duPont Rayon Company, Fabric Development Division)

A Tip to Hoy— or More Pilot Trouble

By Francis D. Walton

Aviation Editor of the New York Herald-Tribune

THERE has been a growing volume of discontent from the flying gentry of the country against the display of news concerning aircraft accidents. This case for the pilot was stated recently by Lieutenant Benson Hoy in the June issue of AERONAUTICS. It was well stated, if Lieutenant Hoy will permit one to say so, one who admittedly knows a trifle more about a split infinitive than he does of the cause and characteristics of the flat spin. It was stated with humor and vigor, and a trifle of heat, and the heat unfortunately was the cause of obscuring a number of vital points of truth.

It is difficult to understand why the volume of objection should begin to grow just at this time, when newspapers throughout the country have been doing so much to develop public support for aviation. Perhaps the pilot is just becoming articulate. Perhaps he is just beginning to appreciate the amenities of the gentle art of writing.

At the very outset it will perhaps be best to break the bad news (as gently as possible) to Lieutenant Hoy that air accidents will for a long time continue to be news, and in cases where the fatality is unfortunately high, front page news. The flying fraternity will graciously concede that perhaps a newspaper editor knows a trifle more about running a publication and selecting news than the conscientious pilot, who with the interest of all aviation at heart, would rather like to see the account of that little Sunday mishap in which he killed his three passengers tucked away among the "Help Wanted" ads.

Let us consider this hypothetical case a moment. Why did that pilot, taken, the chances are, if we are to believe Lieutenant Hoy, unexpectedly with pilot trouble, have those three passengers to kill or injure? The chances, if we may have ours now for the sake of argument, are that they went out to the airport to find out what all this flying business is about wholly as the result of interest kindled in the subject by the newspapers. If this is so, and we are conceding it to be so, the newspaper has a responsibility, not only to those people, but also to the people who may go next Sunday and the Sunday after. The only way in which the press can rectify early enthusiasm generated by much space devoted to the successful flight of a Lindbergh or a Chamberlin is to give full measure of detail to Sunday's little regrettable occurrence.

There we have the argument of space. Also it must be said that more columnar display is given to the airplane accident than to the automobile accident which takes the same toll because, unfortunately perhaps, the airplane more completely meets the requirements of the definition of news. The retort that the plane is now twenty-five years old and its waywardness should no longer be looked upon with more curiosity than the automobile is to permit one's enthusiasm to shut out the true facts of the case. Men have traveled on the surface of the earth since the dawn of creation. To travel through the air, however, has merely been a dream for most of that time and one that was only realized in a measure for the first time at the opening of the Twentieth Century. Airmen must excuse the natural curiosity of groundlings if interest continues to exist concerning each and every phase of flying.

But Lieutenant Hoy's argument, and it is that of many flyers, has not yet been answered. They charge and complain particularly of the explanations of air accidents given in newspapers.

Now no one likes to indulge in the old Army game of "passing the buck," (Oh, no!) but when it can be so easily passed the temptation is beyond human capacity to resist. So let us ask, first of all, who knows best or should know, what caused the failure of the airplane? The pilot, it seems, is the answer. But I call upon the whole fraternity of the gentlemen of the press to tell me if they have ever found a pilot who was at all willing to discuss (with the press) an accident in which he had a part.

Until quite recently only strong arm methods have been used on many airports to dissuade reporters from gathering all of the known facts regarding a crash. Reporters were chased, shooed and even threatened with arrest. The pilot, if he escaped uninjured, was permitted the sanctuary of the operations office, and newspaper men were left to get their information where they could. Is it any wonder that, in a certain amount of bafflement, they were inclined to presume "that the motor failed"?

Lieutenant Hoy has given a number of amusing and glaringly inaccurate examples of what reporters can do with an innocent ground loop. But I'm afraid that the lieutenant didn't remain around to explain the incident to the reporters. He left them to find out for themselves.

But now we come to the real crux of the complaint against newspapers. There has been a regrettable tendency in newspaper accounts of air accidents to speak knowingly of things that no one could know—to say that "the motor failed," "the plane fell out of control," etc. And in most of these cases Lieutenant Hoy now tells us it is fair to assume that the real difficulty was "pilot trouble."

That is a generous gesture, but I'm afraid, oh men of wings, that we who write of your momentary lapses from the clouds must go on saying that your ships spun down, or fell out of control. To be sure, following the suggestion given we might write something after this fashion:

"Four persons were killed and two seriously injured here this afternoon when a cabin plane crashed near the western boundary of this field. The only cause for the accident, as far as could be learned, was that the pilot was asleep at the switch. In a minor difficulty he lost his head completely, and in the ensuing brain storm he attempted to stretch a glide in order to miss a landing on an unobstructed fairway of the Old Timers Golf Course and accept one on the rough boundary of the field."

Yes, we might write such stories; and then we could look for other employment. For there are laws other than that discovered by Dr. Newton. The libel laws, for example. If I know my pilots they would prefer inaccuracies regarding assumed mechanical failure that will disappear and be forgotten with the next edition rather than such truths, which unfortunately, in open court, could not be proven.

I think most aviators will admit that their sense of news values is not quite as acutely trained as that of paid news writers.

I recall an incident which occurred on old Curtiss Field in the spring of 1927 when Clarence Chamberlin was preparing the Columbia for its transatlantic

flight. (The destination then was Paris.)

The day was Sunday and the occasion the christening of the Columbia. There were lots of people present, but all in all it was rather a humdrum affair. Then all at once, like a bolt out of the blue, Chamberlin was presented with that not entirely unusual but nevertheless difficult situation of having to accept a one-wheel landing.

How Chamberlin conducted himself in that situation, as consternation swept over the fields of Roosevelt, Curtiss and Mitchel, the latter where Chamberlin finally made his landing, is now a matter of record, of glorious record, mainly due to the presentation of his action in the press. As the writer was leaving the field two pilots twitted him, saying, "Well, Big Boy, it's too bad, but Clarence cheated you out of a good story today!" In his surprise the writer could only smile at such an infantile conception of news, and he let the two-column story in his paper the following morning answer the ridiculous assumption that Chamberlin's display of courage, resourcefulness and skill had "cheated him out of a story."

Now why was this a "good story," and why were the pilots in error on their news judgment? Because it was a one-wheel landing? No. I'm afraid the slow education of reporters, which most pilots believe to be non-existent, has carried most of them to a sufficiently high technical understanding to know that a one-wheel landing is not something extraordinary. But Chamberlin had two small children in the plane, who were his guests and for whose lives he was responsible. That was one feature of great force in making the story. Another was the fact that the mothers of the two children were on the field, watching a man in the air whom they hardly knew, in whose hands fate had suddenly placed the welfare of their children. The plane was well known, it having established but a few days before the world's duration record. And also on the field was G. M. Bellanca, designer of the ship, who looked skyward, wondering if one of his dreams of a lifetime was about to come to an end. Pilot, is that a story?

Incidentally it may be recorded that the handling in the metropolitan press of New York next morning of Chamberlin's exploits won Chamberlin the right to fly the Columbia to Germany, as Levine, the owner, at that time was wavering in the selection of a pilot. Public opinion, as a result of the newspaper accounts, decided the issue.

So it would seem that the time has come for pilots to forget their petty annoyances over the aberrations of the press. They should take a broader view of the situation and incidentally wake up to the fact that many of the men representing the national press at least have a working knowledge of aeronautics.

So here is just a tip to Hoy and the men of his flying fraternity to get a little less "press conscious" and a trifle more "press wise." And along with the tip, if we may, we would like to give a suggestion. As we who write have been shown the error in saying, "The plane appeared to burst into flames in the air," "The motor failed," etc., we should like to suggest that they, the flyers, give a little thought to the new, sounder and more cautious phrase, "The plane fell out of control." Lieutenant Hoy says we mustn't even say this. Well, if a plane that cracks up wasn't out of control sometime between the moment it stopped normal flight and the moment of impact on the ground, then what was it? Did the plane fall "in control"? If flyers can believe the latter statement then it is time that someone went about as quietly as possible and gathered up a lot of outstanding Transport Licenses. In lieu of that I would recommend that aviation schools establish a course for neophyte flyers on "How to Meet the Press and Why?"

What Is the Law?

AERONAUTICS announces a new reader service that should prove of great value to owners, pilots and transport operators. The rapid increase of air traffic and operations has brought forward many legal questions which the average attorney is not equipped to answer. Many of these have an important bearing on the business side of aviation.

Here are some simple questions that arise in connection with Aeronautics:

"X" conceals himself as a stowaway in an aeroplane bound on a trans-Atlantic flight. This aeroplane is a scientifically precise instrument. It has a definite carrying capacity. The aviators are compelled to load the plane to the limit of safety. The stowaway is a dangerous excess in weight, an excess which jeopardizes the safety of the aircraft and the lives of the owner and legitimate crew. What rights at sea or in the dangerous flight has the stowaway? The legitimate owner of the overloaded aeroplane on its perilous trip over the ocean compels the stowaway to sign a contract that any money that the stowaway shall receive for stories written by him from his experience as a stowaway, shall be divided 50-50 between the writer and the aeroplane crew. Is such a contract valid?

"A" owns a farm. "B" owns a lot in the city. The law says that "A's" title vests in him ownership in the land to the center of the earth and gives him air rights over his farm to the limits of the sky above. Likewise with "B," who owns a city lot—his rights extend from the center of the earth to the limit of the sky above. "C" owns an aeroplane. Has "C" a right to fly his aeroplane over "A's" farm or over "M's" city block? Is it a case of trespass by "C" to fly over "A's" property without his consent? Can "A" stop "C" from flying through his air rights the same as he can stop "D" from driving an automobile over his farm or over the private driveways of the farm?

Can "C" fly in his aeroplane from one state to another with impunity? What regulations is he subject to in inter-state traffic? If "C" can fly from one lot to another or over as many farms as he wants to without permission of the owners of the land traversed, can he by the same token fly from one state to another or from one country to another without the consents of the states or the countries over which he crosses?

If "C" is not permitted to fly from the United States to Canada without a special permit, does he need a permit to cross Canada on his way to Europe?

Are there individual air rights, state air rights, national air rights and international air rights?

Aeronautics has opened a new field of law. Many new questions of rights have evolved themselves, as a result of the use of the air by the flying machine. Europe has been confronted by the new legal problems for several years and as a consequence has evolved a new branch of the law—Aeronautical Law, which this country must begin to study and adopt concurrently with our development of flying into a permanent pleasure and an every day industry.

An American attorney, Bailey Samelow, who has just returned from Europe where he made a study of fundamental aeronautical law will conduct this department. The publishers of this publication have arranged with Mr. Samelow to write a series of articles on this new branch of the law, which will appear in succeeding issues of this publication. The first one will be printed in our issue of October, 1929.

Mr. Samelow will answer for AERONAUTICS any questions of aeronautic law that may confront the readers of this

(Continued on page 91)

Shooting a night scene in the tank — the wing of the wrecked T-2-D is just beyond the cameramen

Flying Movies

By Frank Wead

MAKING a flying epic for the screen would be simple if actors were aviators, or if aviators were actors. There are a few actors in Hollywood who can fly, and at present a considerable number of directors and studio employees have at least a private license. The majority of these people, however, have taken up the game for recreation or sport. When non-flying actors play parts in flying films it is usually necessary that the audience be made to think that they are at least budding aces even if they have never been in the air. This brings many additional complications into a problem that is not simple to begin with. Looping, diving, zooming airplanes are not easy to photograph.

While most of the experience upon which this article is based is drawn directly from Metro-Goldwyn-Mayer's Naval Aviation production, *The Flying Fleet*,—the original screen play for which was written by the author of this article who also arranged the details of Naval cooperation and assisted in directing the air scenes,—we employed on that picture experts who had worked on such opuses as *Wings*, *Lilac Time*, *The Legion of the Condemned*, *The Air Circus*, and *Hell's Angels*, and had the benefit of their past experiences.

During production, every actor whose part required him to fly actually took the air. The star, Ramon Navarro, traveled frequently between Los Angeles and San Diego by commercial air transport. At times when an actor, Director George Hill, his assistant, and indeed, any member of the company was urgently needed for a scene, he usually could be located in, under, on top of, or behind an airplane on the ground or in the air. The conversation of the entire "company" soon developed into one long naval tailspin.

Our first problem was to shoot the maneuvers of the acrobatic section known as "The Three Sea Hawks" from Light Bombing Squadron Two of the Aircraft Squadrons Battle Fleet, led by Lieutenant D. W. Tomlinson, now Vice President and General Manager of Maddux Air Lines, with Lieutenants W. V. Davis and A. P. Storrs, U. S. Navy, as his section-mates. Other cameramen had tried to take pictures of their loops, rolls and inverted flying in formation and missed. We thought that we could succeed, and subsequent results proved our guess to be correct.

Many of the maneuvers of the Sea Hawks are executed at high speed, so our first need was for a camera plane that could keep up with their F-2-Bs. The fastest two-seater available was an 0-2-U, some twenty miles slower. Before taking off to shoot any maneuver the Three Sea Hawks, the camera plane pilot, the cameraman and myself would talk each move out in detail on the ground and dope out just exactly how the scene would be shot. We wanted the horizon about the center of the screen in every shot, in order that their maneuvers would be especially clear above and below that definite steady line of reference. White clouds in the background also make for beautiful photography. We were grateful for clouds if they appeared but we did not wait for them.

All movement in the completed picture was to be from right to left, as that was the direction of the final big punch in the climax, an attempted hop

to Honolulu. Maintaining a single direction of movement makes for clearness to an audience and helps the dramatic effect on the screen. The Akeley camera was therefore mounted to shoot over the right side of the after cockpit of the 0-2-U. It was not desired to show any portion of the camera plane in the foreground of the picture. The cameraman therefore was limited to the angle between the tail and the right wingtips, and the cameraplane pilot was informed of this and so flew and skidded his ship as to keep the planes being photographed near the center line of that angle. The Three Sea Hawks endeavored to place their maneuvers within this angle.

Akeley cameras have a shoulder bar by which they can be "panned" or moved (pointed) and a train of inertia gearing which tends to maintain a motion once it is started. Bell and Howell cameras are panned slowly by cranks and are not suited for this type of air work. The cameraman selects a lens, after studying the problem, that will keep the planes as large as possible yet give them sufficient field to complete the maneuver in without getting out of the field of the camera. While shooting, the cameraman usually has both legs and body well braced against the slipstream, his eye glued to the finder, a tight grip on the cowling with one hand and the other hand on the Akeley bar the end of which is buried in his shoulder. At times he must pan his camera very quickly with a sudden movement of his entire body, yet must do it so smoothly that the pictures are not jerky as they appear on the screen.

The one rule of a cameraman is to keep cranking to the last moment. On one occasion one of the Sea Hawks drifted over the camera while on his back (upside down), missing it with his head by a scant ten feet, while the cameraplane pilot was blind on him. The resulting pictures were practically close-ups, but too large to be of value.

In photographing a loop, for example, the cameraplane would dive full gun. The Sea Hawks would approach from the rear and on a line some fifty yards out from the camera ship, which their greater speed caused them to overtake rapidly, and slightly below it. When about on the center of the angle between the wing and tail of the 0-2-U the Sea Hawks would start their loop. At the completion of the first quarter of the loop, the cameraplane pilot would skid to the left to keep his right wing out of the picture. As the Hawks went over onto their backs he would cut his gun and stall so as not to pull away from them too rapidly in the opposite direction. As they started to dive off their backs he would go full gun again so that they would not pull ahead of him too quickly. Each stunt would be repeated until the 200 feet of film in the Akeley was exhausted. Upon landing all hands would talk it over, decide just where the shot was missed and possibly alter some detail of the plan for shooting it. On the following day the pilots, director, etc., would look at the film rushes and definitely determine whether the shot was o.k. or must be made over again. In a similar manner a detailed method was worked out for each stunt.

It was necessary to identify the single seaters in which our principals were supposed to be flying. This was done by painting their tails distinctively, by numbering them in large figures, (with water color paint, which does not damage fabric but which does require constant touching up) and by giving Ramon Navarro a white neckerchief, presented, needless to say, by the fair Anita Page as a token of her undying affection. The actors were seen climbing into the planes on the ground. The planes taxied out and took off,—a pilot having replaced the actor.

Cutting close-ups or big-heads into long shots of these planes in flight completed the unmistakable identification of each actor as actually being in and piloting his respective ship. These closeups were usually shot in a two seater. The pilot in the rear seat ducked his head out of the camera field, the windshield was painted at the lower corners to further obscure the rear cockpit, the ground swirled and turned in the background of the picture, the actor in the front cockpit went through the motions of flying and other specified actions, started the camera, and the scene was made. Some closeups, however, were made on the ground, shooting up, with wind machines furnishing the propeller blast, and moving clouds were subsequently double-printed into the background. These latter were made during the "retake" period of the picture when they were so urgently needed that time was not available for shooting them in the air.

All "single-seater" close-ups that were shot in the air were made with motor-driven Bell and Howell cameras secured to the fuselage on saddle mounts. These mounts consist of a base plate and belly bands that go around the fuselage, and hence are quickly demountable and do not cut into the airplane structure or the fabric in any way. The camera and film container are screwed and wired to the base plate. A battery to supply current to the camera motor is secured in the cockpit or baggage space, and the switch to start and stop the camera is placed convenient to the actor's hand. The actor and the pilot or pilots involved are instructed as to the action of each scene before taking off. In the air the actor acts as his own director.

Saddle mounts were secured aft of the engine, where, if the camera is shooting forward, the upper cylinder heads show in the lower part of the screen,—such shots were used in the dog-fighting sequence of the picture, the pilot of the following plane keeping the plane ahead in his telescopic gun sight which was boresighted or aligned with the lens of the camera, (Davis and Storrs were able to follow each other through half rolls, vertical dives, etc., without difficulty). If the camera is shooting towards the tail from the same location the face of the actor clearly shows in the foreground; hence this angle was used in shooting single-seater close-ups, the pilot of the two seater ducking out of sight as above.

The Bell and Howell camera carries

THE END OF THE T-2-D
The survivors being photographed on the wing in Mid-Pacific—just off the end of the Del Rey Pier

four hundred feet of film; each scene runs say forty or fifty feet. On one hop we gave Ralph Graves four scenes to shoot, two takes of each scene (one for domestic, the other for foreign negative). These scenes required Lieutenant Logan, flying Graves, to keep his ship in a steep turn, so that the ground would swirl in the background, yet to keep his head ducked between his knees, and required a single seater flown by Lieutenant Davis to ride Logan's tail in such a position that his ship clearly showed in the background of the picture, while Graves supposedly flew the leading ship and registered pleasure, anger, chagrin or what have you. The eight scenes were perfectly made on the first hop, with some twenty odd feet of unexposed celluloid left in the magazine, which speaks most highly for the teamwork of all concerned.

The other saddle mount set-up used in the dog-fight was located just behind the pilot of a single seater. The pilot wore the white neckerchief, which identified him as Navarro, or wore ordinary flying clothes when he played the part of Graves. No faces show from this set up. The plane ahead was followed through its maneuvers by pointing the following plane and hence the camera secured to it; the back of the pilot's head and the wings of the latter plane showed in the foreground, and the entire other plane was seen ahead of it.

COCKPIT CLOSE SHOTS
The NX-2 showing the camera mounted on the wing for close-ups of the pilot

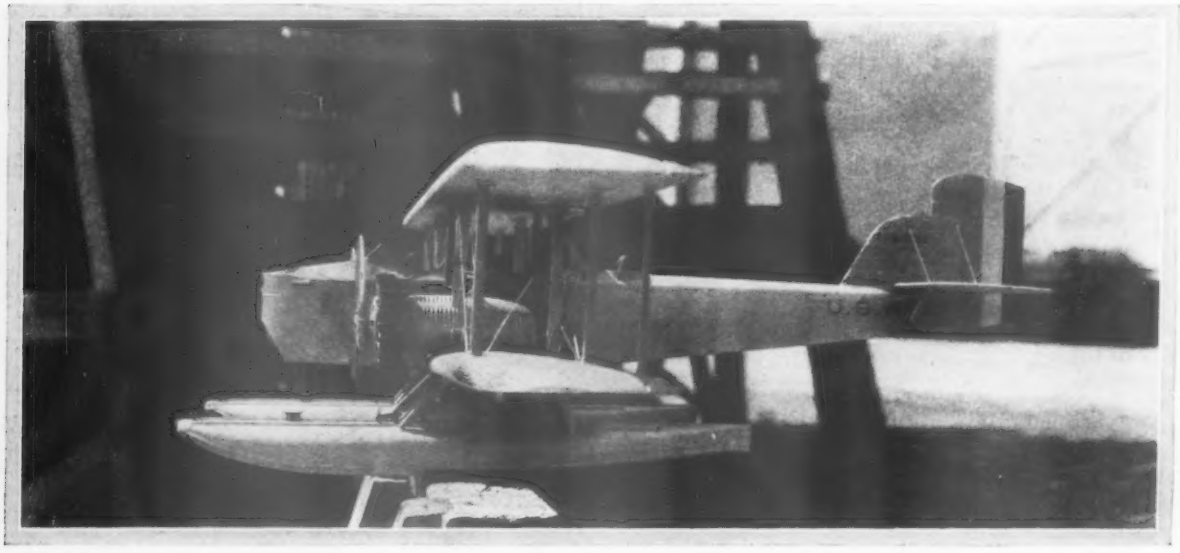
This brings up the question of viewpoint. In making long shots of formations or single ships, if part of the camera plane shows in the picture the illusion of the audience that they are viewing the scene through their own eyes is to some extent destroyed. In such scenes as those of the dog-fight, however, the viewpoint of the audience should be that of the pilot. This is accomplished by showing the wings and struts of the plane on which the camera is mounted in the picture, just as the pilot sees it, and thus the audience feels that they are actually riding with him.

In shooting mass formations from camera planes and from the ground we arranged to do so at times when such formations were being flown for practice, tactical training or review, thus interfering as little as possible with the routine work of the units. Admiral Reeves, Commander of the Aircraft Squadrons, Battle Fleet, Captain McCrary of the Naval Air Station at San Diego, and Admiral Raby at Pensacola afforded the "Hill Company" splendid cooperation, and it is for this reason that *The Flying Fleet* gave as accurate a portrayal of Naval Aviation as it did.

For economy it was not desired to take the entire cast of the picture to Pensacola, where all the training sequences were supposed to take place. Close-ups in the air, both dual and solo, were made in an NY-2 at San Diego, over a part of San Diego Bay and county that does not look unlike the country near Pensacola. Wing mounts were used. One such mount at the outboard struts showed both cockpits, and was used for shots of dual training, and also for solo shots, the pilot bending so

(*Continued on page* 96)

A NEW USE OF MODELS
Models like the one below were used for the crash sequences so as not to endanger the pilots

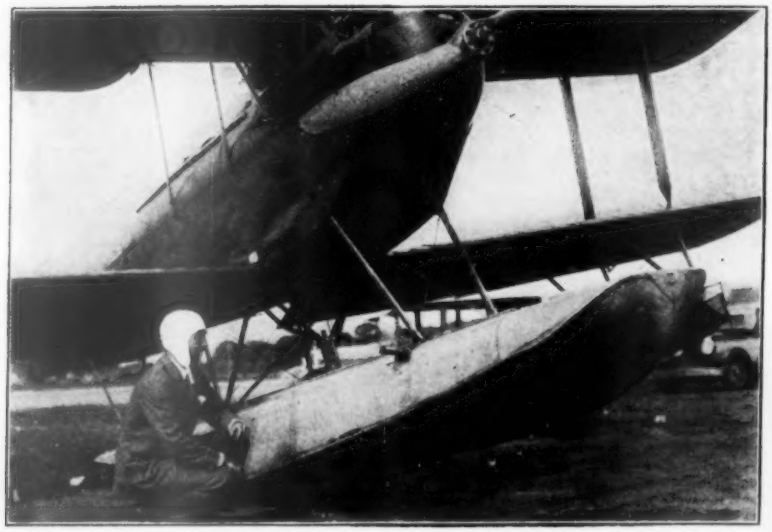


In the Floodlight

A few of those whose recent activities have brought them into prominence

Captain Frank M. Hawks, who hung up the record hop from East to West and back again in a total flying time of 36 hours, 48 minutes and 28 seconds, in his Lockheed Air Express

Roger Q. Williams and Lewis A. Yancey, who successfully spanned the Atlantic and landed not far from the spot near Santander, Spain, where their French rivals landed



Grover Loening and his new one-wheel amphibian. The wheel may be raised into a pocket with doors and can be locked into position

Miss Bobbie Trout has earned her transport license and is said to be the first woman test pilot—being employed in that capacity by the Golden Eagle Airplane Company

Great Resorts of Europe From the Air

TROUVILLE
This popular French resort is opposite Deauville, and the air photo shows the Casino

MONTE CARLO
From the Corniche Road the Casino, the Harbor and the Palace of the Prince of Monaco are easily distinguished, even at night

BIARRITZ
Biarritz is one of the most famous of the French show places, and attracts great crowds

Future Possibilities in Aircraft Engine Design

By W. G. Meyers

HAD suitable power plants been available the advent of practical, dynamic flight might not have been delayed until 1903. A new day in aviation development may come, not through further improvement in the design of the airplane proper, but through revolutionary improvements in the design and construction of the power plants now in use. The aeronautical industry is deeply interested in this all-important phase which may bring surprising changes in present day design.

Some may look upon the conclusions I have drawn as unwarranted, and some of the possibilities forecast as in error.

However, before getting down to business, let us survey and analyze the prime requirements that must be met by aircraft power plants.

Most of us, I think, will agree that reliability deserves first consideration. The recent remarkable endurance flight of the Army's Fokker monoplane "Question Mark" is indicative of the wonderful reliability and ruggedness of the typical present day aircraft engine. During the total time of over 150 hours in the air, the three aircooled radial engines were run at from two-thirds to three-quarters throttle opening.

Evidently, it was the ignition system that showed signs of giving out first, in the form of fouled plugs, which caused a considerable loss in R.p.m. and misfiring. However, it was not because of ignition trouble that the ship was forced to discontinue its flight, although this no doubt would have been the case after less than fifty additional hours, had not the flight been ended by the appearance of a purely mechanical trouble.

The Question Mark was forced down by worn rocker arms; their play had increased from a few thousandths to nearly half an inch. This caused the left outboard engine to go out of time, and hence it could not function.

When the flight ended, the left engine had quit; the right engine, while running, was streaming oil, and the center engine had dropped to 1300 R.p.m. During the final fuel contact, the ship lost 1500 feet altitude, and took on fuel with the left engine dead. Immediately following contact, Staff Sergeant Hooe climbed out on the catwalk in a vain attempt to start the engine again.

Thirty hours before the end of the flight, engine trouble had threatened to send the ship down. All three engines at one time appeared doomed, but the troubled cleared away and the fliers thought then that it would be possible for them to stay in the air indefinitely. At one o'clock on January 7, the final day, Lt. Quesada handed the controls over to Capt. Eaker, and at that moment the left engine quit. With the heavy load, it was impossible for the two weakened engines to keep the ship in the air. She lost another 1500 feet in turning so as to maintain a safe gliding distance from the field. Then Capt. Eaker shut off the right engine and glided toward the Metropolitan airport.

A host of lessons are to be learned from such an experience as that just related. It shows that if not given frequent top overhauls and occasionally a complete overhaul, an engine can become unreliable before its useful life is over. If this was true of the wonderfully cared for engines of the Question Mark, how much more true is it of the roughly handled commercial engine? Commercial airline operators look forward to a day when engines will be on the market which will operate under adverse conditions for their total running life with a negligible amount of servicing, and of which their pilots may be assured that they are flying behind an engine of peerless reliability; or, in other words, an engine which will just "get stale all over" instead of developing specific kinds of trouble in well defined spots, so that treacherousness, which is so characteristic of present types of engines, will be eliminated and ample warning will be rendered sufficiently in advance.

Troubles in present day engines may be divided into four main categories: ignition, carburetion, compression, and mechanical. The same could have been said of the first Wright engine of 1903. In twenty-five years of aviation service, trouble from these sources has not been eliminated. Therefore, it is doubtful to some observers if the gasoline engine will ever be capable of meeting the requirements of the ideal aircraft power plant.

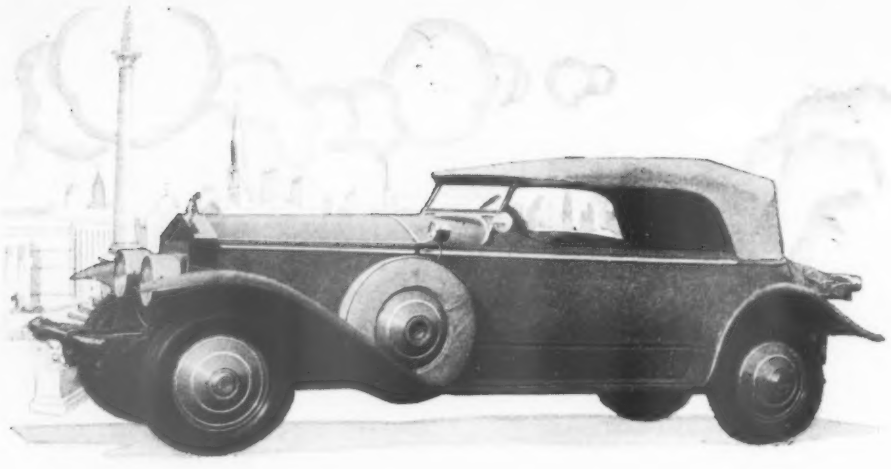
A survey of the history of the aircraft engine shows that, in the interest of light weight, every conceivable cylinder arrangement has been tried, but in this country they have all boiled down to the radial type. Abroad, however, the watercooled vertical, V, and W types still predominate over all others, but that, no doubt, is due to the fact that foreign governments have not as yet realized the advantages of aircooling and still encourage the watercooled principle.

The aircooled engine was tendered its initial boost by the United States Army, which, in 1920, realizing the wonderful possibilities of this type of power plant, gave contracts to the Wright Aeronautical Corporation and to the Lawrence Aero Engine Mfg. Company, each for four radial aircooled engines, and later established a special test program at McCook Field (now Wilbur Wright Field), Dayton, for the purpose of testing different types of aircooled cylinders, which information was later released for the benefit of American designers.

Only aircooled cylinders were tested on a special test "rubber engine," which was a base designed for testing cylinders, either air or water cooled, with a bore range of four to eight inches and a stroke range of four and one-half to nine inches. This research was carried on for four years, and when completed made available for American designers cylinder studies which are the basis for the highly successful American radial aircooled engines of today, the best in the world. The types tested included axial fins, circumferential fins, flat heads, roof heads, integral heads, bolted on heads, etc., all of which proved more or less unsatisfactory until the construction utilizing a steel barrel with a shrunk and screwed on aluminum alloy head was experimented with.

Considering the effect of cylinder diameter upon unit metal weight, it will appear that from that standpoint, the cylinder should have as small a bore-stroke ratio as possible, since the volume of a cylinder varies as the square of the bore, while the circumference, and hence the weight, varies directly as the bore. Also the wall thickness of steel cylinders is always greater than the maximum

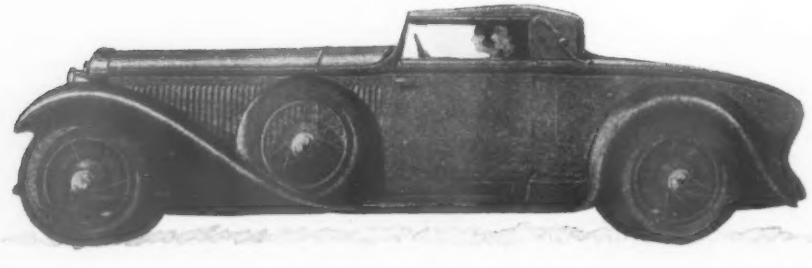
(Continued on page 84)



ROLLS ROYCE "DERBY"
Mounted on the new "Phantom" chassis, the "Derby" has rakish lines without offending good taste by being too "sporty." The effect of power is evident, down to the design of the fenders

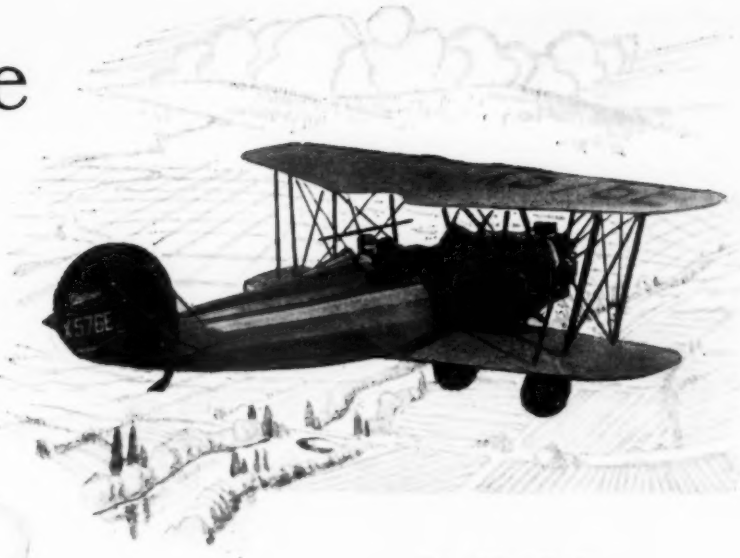
To Reach the Airport

PEUGEOT "PONY"
A light sport car for casual use in town or country. The body finish is novel and the short wheelbase has its advantages in these days when parking is a problem



ISSOTTA-FRASCHINI
The Italian makers also show the influence of aviation designs in this Issotta roadster with its carefully streamlined body by the celebrated Castagna

Three of the Latest

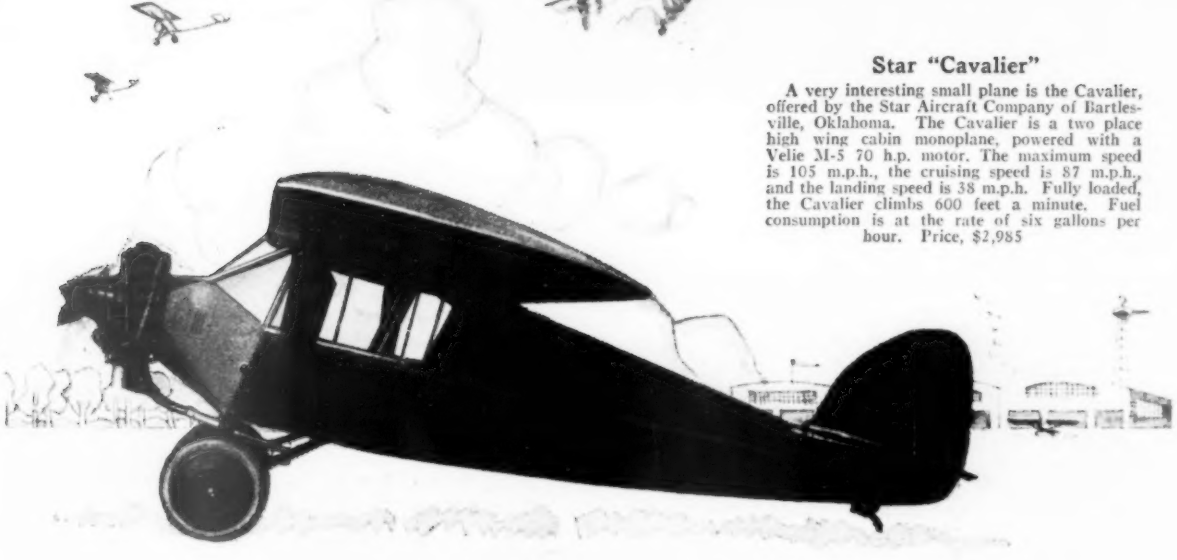


Fairchild "KR 21"

The newest Fairchild is a veteran of proved sturdiness and ability, a combination sport and training plane providing stability, performance, and economy. The KR 21 comes with a Kinner 100 h.p. engine and flies two people, 23 gallons of gasoline, 3 gallons of oil and whatever is left of a disposable load of 600 pounds at a top speed of 120 m.p.h. Price, $4,685

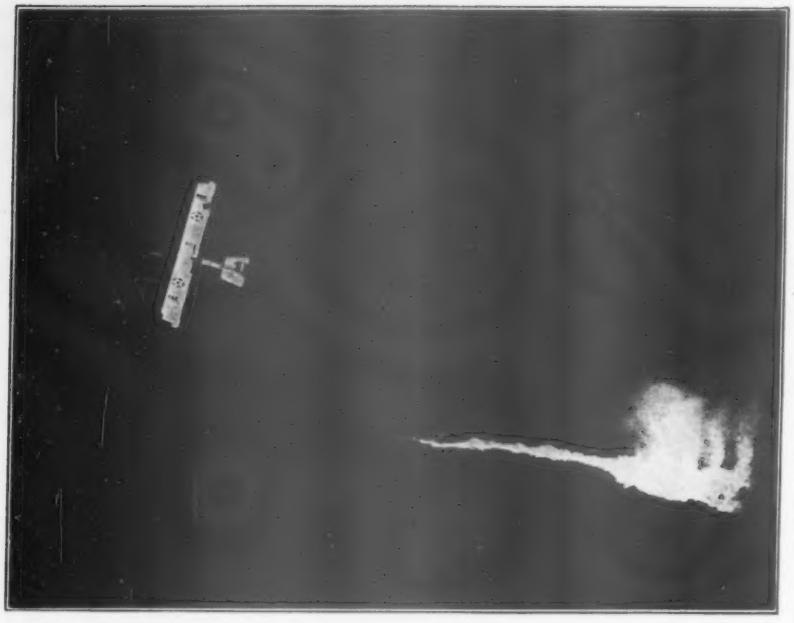
Star "Cavalier"

A very interesting small plane is the Cavalier, offered by the Star Aircraft Company of Bartlesville, Oklahoma. The Cavalier is a two place high wing cabin monoplane, powered with a Velie M-5 70 h.p. motor. The maximum speed is 105 m.p.h., the cruising speed is 87 m.p.h., and the landing speed is 38 m.p.h. Fully loaded, the Cavalier climbs 600 feet a minute. Fuel consumption is at the rate of six gallons per hour. Price, $2,985



Alexander "Bullet"

Special interest attaches to the Alexander Eaglerock Bullet because of its exceptional performance with motors of comparatively low power. The Bullet is fitted with either a Wright J-6 165 h.p. engine or a Kinner 100 h.p. engine. The plane shown below is the C-3 Bullet, equipped with the Kinner power plant. This model carries a pay load of 670 pounds and 40 gallons of gas and does 130 m.p.h. at full throttle. Cruising speed is 111 m.p.h., and landing speed is 42 m.p.h. Prices: C-1, $8,888; C-3, $6,666.



Airing

The plane has just dropped a torpedo from its undercarriage

A LETTER which came to me recently from a naval flying officer, who was on duty with the aircraft carrier Lexington during the maneuvers at the Panama Canal Zone, sounded off with proper pride about the performance of the air squadrons, and the vast difference in their rating now as compared with the lesser regard in which the high command held them a few years ago.

This naval flyer prefers to remain anonymous, and I quote from a personal letter not originally intended for publication. There is nothing in it, however, which should offend the most punctilious Admiral bent on keeping junior officers in their proper place. The letter says, in part:

"We had a big war here. After it was over the Commander-in-Chief sent the following message: 'I desire to commend all hands for their excellent performance in the maneuvers . . . . especially the brilliant performance of the Air Force.'

"A division of four battleships was assigned to the sole duty of guarding the aircraft carrier. To those of us who have seen the inception of aviation in the fleet that is a tremendous concession. It's like—well, imagine King George V, Von Hindenburg, Cal Coolidge, Charlie Hughes, and Senator Heflin acting as a squad of motorcycle cops clearing the way for Trotzky's automobile."

There has been naval aviation since before the beginning of the World War, but most of its high-power development has come since the first torpedo-plane maneuvers, seven years ago, off Cape Henry. Pioneers like Richardson, Ellison and Rodgers had accomplished much before those maneuvers; it was, in fact, their work that made the later development possible. And they worked against prejudice and handicap.

These handicaps were not imposed by all the old line officers of the higher commands. The brilliant exceptions were Rear Admiral Fiske, retired, and Rear Admiral Moffett, who became, and still is, Chief of the Naval Bureau of Aeronautics. Fiske was the first admiral to trust himself to an airplane; he exchanged his brass hat for a helmet to fly in one of the earliest types of naval planes. Moffett has flown all over the United States and its surrounding coastal waters in airplanes and dirigibles.

Moffett was the first admiral to see that the advent of aircraft meant the beginning of the end of secrecy about armament. There still are many admirals who do not agree with him, but the idea has gained much ground in the last seven years.

Admiral Moffett permitted myself and several other writers with the Atlantic Fleet for those historic maneuvers, the remarkable and unexpected results of which were quickly reported by every important embassy at Washington to the powers interested. I quote from my own dispatch to the group of newspapers for which I was writing at the time:

"The battleship Arkansas of the Atlantic Fleet was technically destroyed today when she was hit nine times in sixteen minutes by a fleet of torpedo planes.

"These seaplanes spoke unmistakably the latest word in naval offense, and this word tells the world that the United States is equipped with a new and singularly powerful weapon not possessed, at least to such an effective degree of development, by any other power.

"Seen from the foretop of the Arkansas, it was an amazing spectacle. With almost mechanical precision eighteen torpedo planes came down from sky to ocean—or just above it—and, one after another, shot their great projectiles—except one whose release failed to work. Of seventeen torpedoes fired nine found their mark against the great warship.

"Most of the hits were in vital spots. The first struck the port side almost amidships; and there were expressions of reluctant admiration from the naval officers, who believed a battleship to be almost invulnerable to attacks of this kind.

"Impartial observers believe that, although actual gunnery would have shot down most of the torpedo planes before they could have launched their potentially deadly missiles (there were, of course, no warheads on the torpedoes nor explosives in them), the attack nevertheless would have been successful. A few hundred thousand dollars' worth of aircraft would have destroyed forty million dollars' worth of warship. The loss of life would have been proportionate.

"One of the unexpected developments was the throwing out of formation of the fleet in the attempt to dodge the aerial projectiles. This would have been fatal in warfare. A collision between the Arkansas and the Utah was averted only by superb seamanship.

"Naval officers, headed by Rear Admiral John D. MacDonald, expressed surprise at the result of the attack, for the Arkansas maneuvered with great skill, literally writhing at top speed to dodge the torpedoes.

"The planes, which were makeshift craft built by the Navy, came ninety miles from the Norfolk Naval Air Base, to launch their unrehearsed offensive in a maneuver which has made naval history."

There may be disagreement as to the future value of the torpedo plane in naval warfare, but there is none as to the impression made on the Navy on that September morning seven years ago. Pages could be read in the faces of the older officers. Their comment was unnecessary. They had been much

Armament Secrets

By John Goldstrom

more profoundly impressed by the work of their own flyers than by General William Mitchel's bombing demonstrations against naval craft the year before, shattering as they had been.

A hard blow was dealt, too, to the notion that new developments in armament can be kept secret. To the group of observers that returned with Admiral Moffett on a destroyer to Norfolk, the man under whose supervision the test had been conducted said:

"What's the use of trying to keep such things a profound secret? We know that the other fellow finds out all about them as soon as they are perfected—and we know pretty well what he is doing."

The truth of this was evident enough to an aeronautical writer whose job it was to keep in touch with new developments. Frequently my own contacts brought me news of things I was asked to keep in confidence. Doing so, the news invariably broke out from some other quarter. Usually the embassy attache whose job it was to keep his government informed had full knowledge of new inventions or tactics before the United States War College knew about them.

Example: One of the several surprises sprung at the Cape Henry maneuvers—a surprise so far as most of the public was concerned—was the Hammond right-angle torpedo. In every case except one, the plane about to launch its torpedo attacked with its nose pointed against the side of the ship, or just ahead of it, dropping the missile when within a few hundred yards of its objective. But one of the planes flew on a course parallel with the Arkansas and, when a short distance ahead, shot its bolt. The torpedo traveled on the parallel course for a few yards and then, controlled by a special mechanism, turned at right angles and headed for the side of the ship. It was a direct hit.

The increased advantage toward accuracy was obvious. The demonstration was one of the big thrills of the maneuvers, and naval officers who knew all about torpedo fire rubbed their eyes in amazement. . . . . I know that at least one foreign attache knew all about this invention months before the maneuvers.

It has been declared that the United States Government is the only one that does not employ spies abroad. If that is true, its attaches at the various embassies in Europe and Asia are remarkably resourceful men. Their cooperation with the military intelligence service is highly efficient.

Soon after the Washington Conference for the Limitation of Armament, American naval officials learned that Great Britain had found a way to beat tonnage and armament parity with the United States by elevating the angle of fire and thereby increasing the range of its big naval guns. . . . . Congress learned about it months later.

The United States has no diplomatic relations with Soviet Russia; yet it is very well informed as to military developments in that vast land. Possibly it gets most of its information from British and German sources.

The Soviet Government itself is wary of American observers. I have traveled by airplane between Berlin and Moscow three times. Each time, on approaching the military airdrome at Smolensk, about 250 miles west of Moscow, the curtains of the cabin have been drawn. I was not specially interested in Soviet Russia's military aviation, but could have procured fairly complete and reliable information about it without entering Russia.

There is of course a perfectly legitimate system of exchange of information among the military and commercial attaches of practically all countries. Aviation has extended the range of such information enormously.

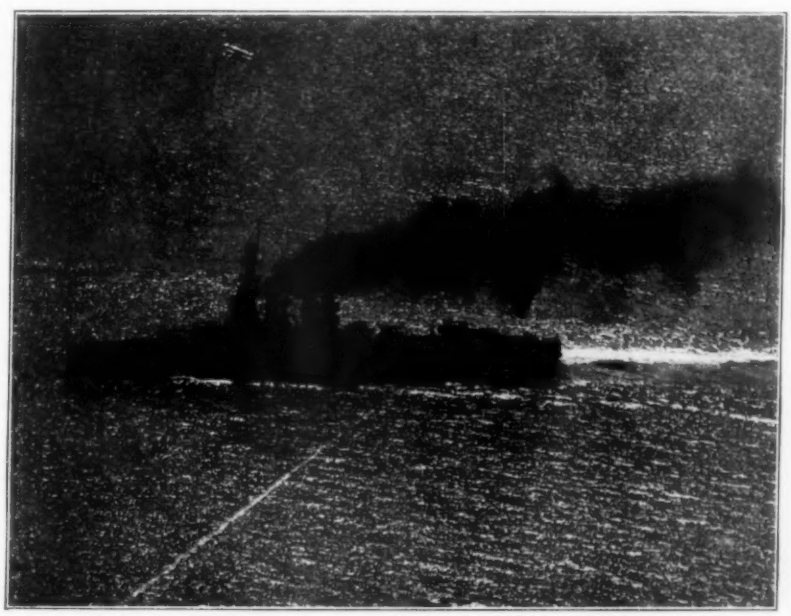
The various war colleges have come to realize that there isn't much in the way of war plans, or plans for national defense, as they prefer to call them, that can be kept secret. Secrecy is limited largely to the invention of new tactics with known weapons; and the new weapons speedily become universally known. Foreign attaches are permitted increasing latitude at American airdromes.

There isn't a great deal about military aircraft performance that can be kept secret very long. The sky is an excessively public place in which to work. This year's record-breaking speed planes are next year's pursuit planes, and anyone who desires can have complete plans and specifications of them.

It is no longer a dark secret that Japan objected at first to having the American Round-the-World flyers land

A Hit!

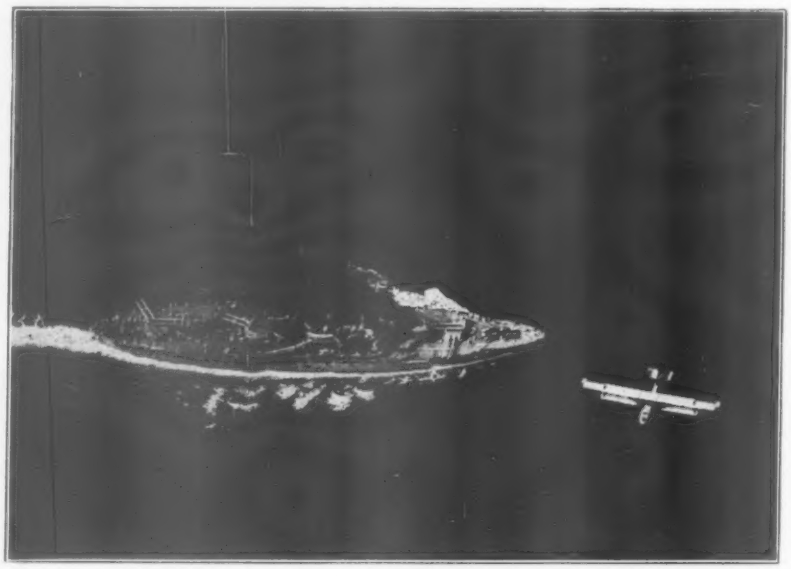
The first torpedo dropped by Lt. Gray in the attack registered a perfect hit. Notice the wake



on Japanese soil or on Japanese waters. It was thought at Tokio that the flight might demonstrate to the people of Japan that their country was vulnerable to American attack from the air by way of the North Pacific. Their objections were finally overcome, but not without diplomatic difficulties.

When the planes arrived in Japan, Lieutenant Erik Nelson, engineer officer of the flight, observed Japanese furtively taking notes and making photographs. One was using a measuring tape when he thought none of the American flyers was looking. Smilingly Nelson drew a set of blueprints from one of the cockpits of his Douglas cruiser and presented it, with the compliments of the United States Army Air Service, to a Japanese air officer.

The officer was somewhat amazed. Some of the Oriental impassivity of his face fell from it. Japan, itself the most secretive of all the world powers in military matters, had been presented with plans and specifications of an American military plane which had demonstrated its ability to invade sacred Nippon. It was incredible.



ANOTHER HIT!
The wake of the torpedo showing a hit. A photographic plane is passing the bows of the U. S. S. Arkansas

It is a fact that the job of the international spy has become less profitable the world over. This is particularly true as it relates to Washington. He thrives best and most romantically in detective fiction. The United States Government has taken the lead in a movement that may reduce his work to negligibility in the not distant future.

Some of our government officials, however, were still profoundly silly about airplane secrecy in the nervous years just after the Armistice. An example:

When Lieutenants John Macready and Oakley Kelly made the first nonstop flight across the United States, the plane was announced officially as an American Army transport plane—the T-2. I observed to a headquarters officer that it didn't seem like giving even an alien an even break not to call it a Fokker. No Fokkers were being made in the United States at that time—in 1923—and the Dutch designer had not yet applied for American citizenship papers.

My friend the officer grinned, and said that, officially, the plane would be known as a T-2, "developed" at the Army Air Service's engineering field—McCook—at Dayton, Ohio. Yes, it certainly looked like a Fokker, but the war was still an unpleasant memory to Americans whose relatives had been shot at from Fokker combat planes. They might be offended if it were published that the American Army was now buying planes from the Dutch designer.

It is now pretty generally known that Fokker first offered his designs to the British, who turned them down. The ubiquitous Dutchman wanted to make planes, Holland was neutral, so he made them for the Germans. After the war his European market fell off—although many of his passenger ships are still in use on the European airways. His great German rival Junkers finally bested him in Germany. Fokker saw the possibilities of the American market, and so became an American designer by adoption.

Fokker's own European ideas of reticence about airplane design—which have changed with his American experience—led to an amusing incident in the summer of 1925. His Amsterdam manager showed me his first trimotored plane, then under secret construction, behind closed and guarded hangar doors. He did so only because he knew that Fokker had already told me about it in New York, but I was asked to write nothing about it then.

The next day one of the first of the Junkers trimotored planes, manufactured in Sweden to circumvent the provision of the Versailles Treaty prohibiting German construction of multimotored planes, landed at the Schiphol Airdrome near Amsterdam, having casually flown down across the North Sea from Sweden.

A short time previously Fokker, in an address to a meeting of British aeronautical engineers, had declared that commercial aviation was not yet ready for the multimotored plane; there was not enough pay-load in sight for other than single-motored ships. He had given me a copy of the speech, from which I might quote if I liked. But after the arrival of the trimotored Junkers he suddenly announced that, if I liked, I could write that his own trimotor would soon be shown in the United States.

Fokker's designs, which have performed so well in transoceanic and polar as well as transcontinental flights, frankly incorporate features first devised by other designers. His first plane, made when he was a youth, before the beginning of the World War, owned Bleriot as his master.

There have been, as a matter of fact, only three distinctly original airplane designs: the Wright biplane, the Bleriot monoplane, and the Junkers all-metal thick-wing monoplane. All other designs are derivatives. The modern airplane is a refinement and an enlargement of three main principles of design. In this respect it is following, to some extent, the evolution of the automobile.

Perhaps the best example of the increasing American willingness to give the world an even break in things aeronautical occurred when the Schneider Cup races of 1926 were run, at Norfolk.

The Italians had been badly beaten by the Americans the year before at Baltimore, and they came back with planes which gave many evidences of close study of American design, plus some excellent ideas of their own. But just before the race they found their spark plugs would not work. They were invited to try the latest American development in spark plugs. They accepted the invitation, and decided also to substitute American high test gasoline for their own Italian petrol, which had been brought across the Atlantic. They won the race.

(Continued on page 94)

Aviation Stocks in Greater Favor

By B. C. Forbes
and
R. W. Schabacker

SO far as the aviation industry may be said to partake of a "seasonal" nature, that seasonal trend is at variance with the seasonal tendency in most of the key industries of our country. The steel industry, the motor business, the railroads, building and many other important classifications going to make up American industrial activity expect generally to do their best business in the spring and in the fall. During the mid-summer months these classifications look forward to at least a moderate falling off in their business due to various seasonal factors.

The aviation industry, however, appears to be developing a seasonal trend considerably at variance with the above order. The business, from the manufacturing standpoint, depends for its activity upon the demand for equipment which comes from the public. Whether this demand originates directly with the public or comes indirectly through the medium of the air transportation concerns, its development appears to begin, from a seasonal standpoint, early in the year and to continue its expansion through the normally declining months for general business, straight through into the late fall.

The aviation industry has been expanding so rapidly in the past few years that seasonal influences do not exert so great an effect in this as in other and older industries. The seasonal trend is now seen, therefore, in changing rates of a more or less constant advance, rather than in the more usual up and down movements generally attributed to normal seasonal trends. In the future, however, this steady seasonal increase through the summer months should come into greater prominence and producers will undoubtedly find it to their advantage to study such seasonal movements more closely.

For the time being, it is sufficient to note that the aviation industry is one of the few key groups in American business which are sustaining their pace constantly through the hot months of midsummer, and to that extent the aircraft industry should prove a boon to the nation's general business prosperity.

As a matter of fact, "good flying weather" in the hot summer months is not the only reason for such a sustained seasonal trend. Perhaps one of the best reasons is merely a result of the conditions which help to precipitate seasonal declines in other groups during the summer months. This factor is one of general vacation schedules. Summer vacations may bring a drop in the activity of most major industries, but in the case of aviation they bring merely an added demand for air transportation and aviation equipment.

To at least some degree the above factors of a seasonal nature should give a clue to the seasonal movement, if any, in the securities of aviation companies. Nearly every important industry has a more or less well-defined seasonal tendency in its securities as well as its corporate business and profits, and the relation of these seasonal trends is readily apparent. It is usually the case, however, that the seasonal in an industry's security movement will develop earlier than the seasonal in its actual business and profits, since the stock market has the reputation for discounting changes in corporation profits long before they actually appear.

In the present year the general business of the nation has been relatively unaffected by these usual seasonal movements due to the fact that buying power and movement of goods entered the summer season at such a high rate that the mere backlog of business could have carried the key industries straight through the normally dull summer months. The steel industry has led this abnormally high summer activity but the railroads and the motor industry have not been far behind. Likewise, the movement in stocks of such various companies has also been more uniformly upward than might have otherwise been expected.

The stock market, as well as the general business picture, has thus presented a favorable background for the activity of aviation concerns as well as for their securities. Following a period of "congestion" in the general market, in which stock market averages fluctuated within a comparatively narrow gauge for nearly six months, prices broke out of this trading range on the upside around the beginning of June. The "breaking through" after such a long period of indecision indicated a very strong technical position and the general stock market has been in what may justifiably be termed a major upward movement for nearly two months.

During that time representative stock averages have staged the most rapid advance in market history. Such indexes have gained as much as 55 to 60 points in only a little over six weeks, or an advance of around 20 per cent in actual values. The movement has not been particularly surprising in view of the long period of congestion previously mentioned, and after six months of preparation an advance of two months does not seem too much to expect.

These advances have been made under the stimulus of the highest rate of business activity in most of the chief lines seen in many years. The credit situa-

(Continued on page 94)

Aeronautics' Service to Investors

AERONAUTICS offers an advisory service to investors and those seeking information about aviation stocks. The financial department of AERONAUTICS is conducted by B. C. Forbes and R. W. Schabacker, both of Forbes', the nationally known financial magazine. All questions submitted to this department will be answered with as complete and full information as possible. There is, of course, no charge for this service.

Lieutenant Commander A. C. Miles, U. S. N.

Flight Test

VARIOUS methods of performance testing have been in existence since the beginning of the airplane. Claims for high and low speeds were made for even the earliest machines. Little of these data have been comparative, however, and even at this date wide variance exists in the performance obtained between the various testing agencies and various localities in which testing is done.

In general, there are three methods of obtaining performance. These are (1) By calculation, (2) Predictions based on wind tunnel data, (3) Full scale air tests conducted in actual flight. The first method seems to be by far the most common. Most of the data given in prospectus and advertisement are undoubtedly arrived at from an optimistic use of it. The procedure of applying this method is well known. Text books cover it fully and numerous reports by such agencies as the National Advisory Committee for Aeronautics have been issued covering the subject in great detail. Briefly, it consists in calculating the weight, aerodynamic characteristics, etc., of the design and, assuming a power plant, evolving such things as high and low speeds, endurance, climb, and ceiling.

The second method utilizes the data obtained from small scale models in the wind tunnels maintained for this purpose. Very close predictions may be made of full scale performance, the accuracy of which depends in a great measure on the excellence of wind tunnel equipment, the accuracy of the model, the care used in making measurements, and the experience and skill of the individual charged with correcting the wind tunnel data.

Regardless of the performances arrived at by the two methods mentioned above, the Army and the Navy maintain agencies for the testing and obtaining of performance in actual flight of new aircraft. The Army unit is located at Wright Field, near Dayton, Ohio, and the Navy unit at the Naval Air Station, Anacostia, D. C. The methods of obtaining data and their reduction to standard described further on in this article are those in use at the latter station.

It might be well to mention here that it is customary in the services to carry through performance calculations based on drawing board information and wind tunnel data as well as conducting performance tests with the actual airplane. Performance is calculated from preliminary data on weights, size, and power. If the figures arrived at are of sufficient interest, wind tunnel models are made and further performance predictions evolved. When the airplane is built, if ever, full performance tests are made in actual flight. It is not uncommon to have a very close agreement between the performances predicted in these various steps and those actually obtained.

Flight test procedure is by no means standardized. The various units charged with conducting these tests utilize routine and methods with which they are familiar and which appear best suited for their needs. However, it is possible to separate into stages the various elements which go to make up the complete test. These are (1) Demonstration, (2) Inspection, (3) Weighing, (4) Calibration, (5) Collection of data, and (6) Reduction of data.

Demonstration

At this writing, the Navy is requiring thorough demonstration of new aircraft by the contractor. The demonstration varies with the type of craft but in general consists in the manufacturer being required to demonstrate that the plane will successfully accomplish all acrobatics and maneuvers which the type will be subjected to in service. In a way, this is a safety precaution and its necessity has been proven by experience. The demonstration is conducted under the supervision and within sight of authorized representatives of the service.

Inspection

Inspection consists in going over the airplane in such detail as is possible to determine that it conforms to specifications, that instruments, furnishings, accessories, and the like are operable and satisfactory. During this stage, such flights as are considered necessary for familiarization are carried out.

Weighing

Airplanes are constructed under very rigid weight requirements. The effect of weight upon performance is so apparent that no discussion of this feature seems necessary. After a plane which is submitted for test has been inspected, it is weighed and the following data obtained: (1) Weight empty; (2) Location of center of gravity empty; (3) Full load weight, and (4) Full load location of center of gravity. This is done first to determine if contract weight guarantees are met, and second to ascertain if the c.g. location checks with the designed location. Any reasonable method of obtaining these data is acceptable. The simplest consists in placing accurate scales under the three points of the airplane which are in contact with the ground, i.e., the two wheels and the tail skid. The sum of the weights indicated on the three scales is the weight of the airplane. To establish the centre of gravity, the plane is set up with the thrust line level with the ground. Taking moments of the weights on the three scales about any reference point establishes the center of gravity with respect to that reference point. For example, if the point of contact of the tail skid on the scale is taken as the reference point then

$$W_1 \times 1 + W_2 \times 1 = W \times X \text{ or}$$

$$X = \frac{(W_1 + W_2)1}{W}$$

Where W = Weight of airplane as weighed.
W_1 = Weight on left wheel.
W_2 = Weight on right wheel.
l = Horizontal distance between point of contact of the tail skid and the line joining the points of contact of the wheels,
and X = Horizontal distance of the center of gravity of the airplane from tail skid in the level attitude.

Now if the same procedure is followed with the plane in another attitude, such as tail low or tail high, we again obtain the horizontal distance of the center of gravity of the ship from a reference point. Obviously, if lines are struck perpendicular to the horizontal indicating

Procedure

By Lt. Cdr. A. C. Miles
United States Navy

these horizontal distances in the two cases, they will intersect and the intersection establishes the center of gravity of the airplane. As noted above, the weight and center of gravity location is obtained in the empty condition and with service load aboard. Any other special loading, such as bomb

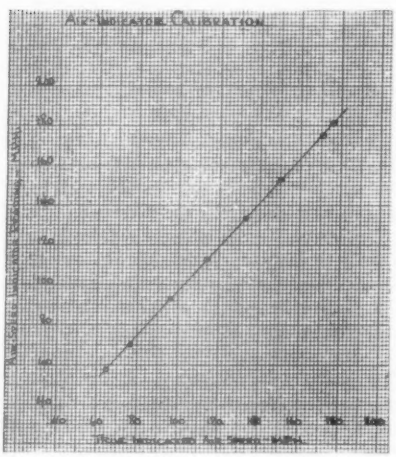


Figure 1

or scouting overloads, are investigated in a similar manner and the center of gravity checked. The locations of the center of pressure of the lifting surfaces are confined within certain definite limits —hence, the center of gravity must be very carefully established and, for safety's sake, located within like limits if equilibrium in flight is to obtain.

Calibration

The next stage is calibration. This requires the greatest care, consumes the greatest amount of time of any of the stages, and hence calls for the most patience. The tachometer is taken out and calibrated against a standard, or a calibrated instrument is installed. A strut thermometer is installed in a location to eliminate effect from engine heat. The propeller is adjusted to give the rated r.p.m. of the engine in level flight at a specified altitude. Next, the airspeed meter is calibrated. This is accomplished by flying over a measured course taking with a stop watch the time required to traverse the space between the markers at the ends of the course. Still smooth air is required for accurate work. Cross-winds must be avoided. Runs are made in pairs at various speeds up and down the course at chosen constant airspeeds. The time of each run is noted and knowing the space traversed the true speed is obtained. The average of a pair of runs, one up and one downwind, is the true speed to be compared with the indicated reading of the airspeed indicator. To reduce to standard in order to construct the calibration curve, it is necessary to apply a correction, taking account of variation of temperature and barometric pressure. Tables are available for this and the method used is that described in National Advisory Committee for Aeronautics Report No. 216 published in 1925. It is customary to make four or more pairs of runs at top speed as this is, of course, the most important bit of data to be obtained during this stage of the proceedings. Additional pairs of runs are then made at slower speeds, the speed being diminished in steps of 5 to 10 miles an hour, depending somewhat on the speed range, until speeds approaching the minimum possible are reached. The lower points are the most difficult to obtain accurately. Frequently, the aid of an auxiliary plane of considerably lower minimum speed is used. This plane is very carefully calibrated in the range of speeds near the minimum of the plane under test and then the two planes flown in formation at safe altitudes. Simultaneous reading of the airspeed indicators in the two planes provides a means of determining the low point calibration of the test ship. As data are obtained, a curve is constructed called the airspeed calibration curve. In this curve, airspeed indicator readings are plotted against true indicated air speeds. If it is impossible or inconvenient to make use of an auxiliary airplane as described above, the lower part of the curve is extended as a straight line and, for the purposes intended, is considered to be accurate. The lower part of the curve is important and is used to determine the landing speed as described later. Figure 1 shows a typical airspeed calibration curve.

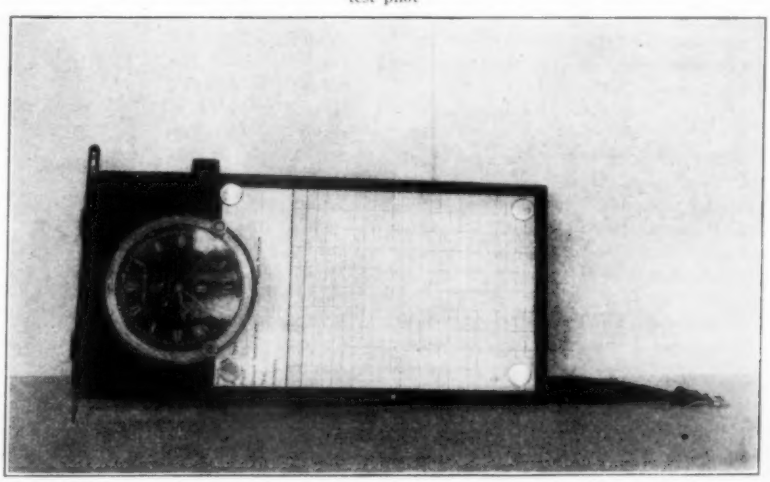
Collection of Data

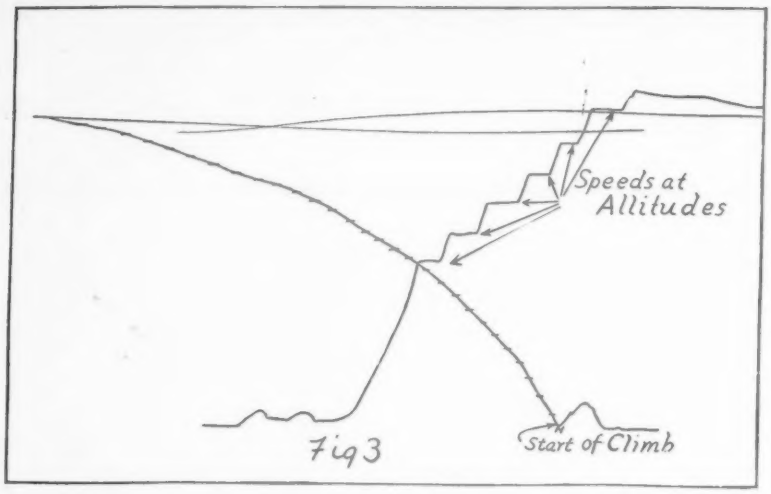
When satisfied with the calibration, the trial board proceeds with the collection of performance data. The high speed has been obtained during the airspeed indicator calibration. However, if the calibration was not made with full load, additional high speed runs are made in this condition.

The next thing to be established is the minimum speed. This is taken to be the speed at which the ship lands in a normal stall landing. As a rule, each member of the trial board makes a number of very careful landings into the wind, noting the airspeed indicator reading at the instant the plane touches the ground. The average of a number of these readings is taken as the landing speed and the true landing speed is obtained by reference to the calibration curve.

Climbing is now in order. The ability

For the Pilot
Stop watch and data card mounted on knee-board for convenient use of the test pilot





BAROGRAPH RECORD
A copy of a barograph record made from the smoked card, showing the data recorded by the barograph

of an airplane to climb is dependent upon the reserve horse power. The power in excess of that necessary to maintain level flight is available for climbing. As the airplane gains altitude the conditions are constantly changing. The power of the engine falls off due to the rarefication of the atmosphere, the weight of the plane diminishes due to the consumption of fuel, the density of the air being less at altitudes the lift diminishes, this requiring greater speed to maintain the same amount of lift, at the same time and for the same reason, the resistance to motion through the air is less and hence less power is required for equal speed. All of which merely means that while climbing, a great many variables enter into the problem. Account is taken of all these variables in climb calculations. The practical matter of climbing the airplane solves the problem without recourse to formulae.

It has been found that in most airplanes the best climbing speed, or the speed at which the most power is available for climbing, is the minimum speed plus one-third the difference between the minimum speed and the maximum speed. That is—

$$V_{climb} = V_{min.} + \frac{(V_{max.} - V_{min.})}{3}$$

This speed of best climb is not far wrong for any airplane and remains fairly constant throughout the altitude range of the ship. The first climbs to ceiling are made starting with this speed and to maintain this speed as altitude is gained the airspeed indicator reading is decreased one mile per hour for every thousand feet of altitude. This method of climbing has given excellent results over a period of several years and is about as fool-proof as any method that has been devised. If any suspicion exists of results obtained by the climbing speeds thus used, it is customary to conduct a series of so-called saw-tooth climbs for the purpose of determining best climbing speeds. Briefly, this procedure consists in climbing the plane at say three different speeds at altitude steps up to near the ceiling. For instance, the plane would be climbed from sea level to three thousand feet at 65, 70, and 75 miles per hour; then from 4,000 feet to 6,000 feet at 60, 65, and 70 miles an hour; again from 9,000 to 11,000 feet at 55, 60, and 65 miles an hour; and so on up to the ceiling. Near the top the variation between climbing speeds needs must become less as the range of speeds over which flight is possible becomes smaller. A barograph is carried on these flights and investigation of the barograph record gives the rates of climb at the various speeds at the various altitudes. These are plotted and a line drawn through the maximum rates indicated gives the best climbing speeds at the altitudes up to ceiling.

In climbing an airplane to ceiling, it is customary to make four or more climbs using different pilots on each climb. A recording barograph is carried and the record obtained therefrom is the basis for obtaining the climb characteristics. The barograph is calibrated to record atmospheric pressures in millimeters or inches of mercury and tables are available for converting these readings to standard altitude. During the climb, it is necessary for the pilot, in addition to maintaining a steady correct airspeed, to make and record simultaneous readings of the air temperature, r.p.m., altitude, and engine data. For this purpose, he is provided with a board which he straps to the thigh of his leg and on which is provided a stop watch, pencil, and data card. Fig. 2 is a photograph of such a board. Readings are required every two minutes until twenty minutes have elapsed and then every 5 minutes until the service ceiling has been reached. The service ceiling is that altitude at which the rate of climb is 100 feet per minute. A climb rarely exceeds 50 minutes in duration. It is customary to carry oxygen on climbs which exceed 15,000 feet and this adds to the complications confronting the pilot. To say he is busy during a climb is to put it mildly. In addition to the items noted above, he must tend his mixture control to maintain maximum engine output (no small item in these days of air-cooled engines and high ceilings with their attendant low temperatures), as

(Continued on page 62)

FIGURE 4
The statoscope is a sensitive manometer indicating minute variations of pressure

YOUR MONEY BACK IF IT FADES, SHRINKS, LOSES ITS FINE TEXTURE

"A The Original BUCK SKEIN JACKET meets all tests"

says

"Lieutenant Prier"

$5.50 *buys this jacket*

WALTER J. PRIER was a pilot during the world war, and he has done considerable flying ever since. He is an aviator of long experience. He knows all the ins and outs of flying. His knowledge and his ideas are sound—even to the jacket he wears when he goes up. But let him tell you about a Buck Skein jacket himself.

"My Buck Skein and I are inseparable. It's got everything a flyer needs—*warmth... comfort without bulkiness*. . . it wears . . . it's easy to wash. I wring mine out in gasoline or wash it in soap and water. Either way the result is just the same. The jacket always looks new.

"This Buck Skein fabric is certainly great stuff. It looks and it feels just like leather. And, believe me, it wears like leather too. Besides, the double button wrist bands, the snug fitting all-wool waist band, and the way a Buck Skein buttons up around your throat, keep the wind and cold out perfectly. The two big military button-through flap pockets are large and roomy.

"As an aviator who judges flying togs for their warmth, comfort, long wear and appearance—well, I can tell you, a Buck Skein Jacket meets all the tests."

MONEY BACK GUARANTEE

If a Buck Skein fades, if it shrinks, if it loses its fine texture, if you aren't completely satisfied, you get your money back.

IMPORTANT

If your dealer can't supply you, send me your check or money order for $5.50 for the Jacket or $3.50 for the shirt and I'll personally see that you get your Buck Skein Jacket at once.

Buck Skein Joe

Buck Skein Joe, % Lustberg, Nast & Co., Inc., *Makers*, Dept. X-9, 331 Broadway, New York City

SEE THAT I GET:	CHECK HERE
A Buck Skein Jacket at $5.50	☐
A Buck Skein Shirt at $3.50	☐

Neckband size.....

Enclosed check ☐ Money order ☐

Name .....

Address .....

.....

They Tell Us—

The Most Important Factor

"It is evident we not only need a National Air Academy but, in the interest of future national defense, our military air service should be completely separated from the control of either the Army or the Navy.

"It is believed that the Air Service will not and should not justify the abolishment of either the Army or the Navy, as there will always remain considerable work for them, but it is evident that the air defenses of a nation will eventually be the most important factor in national defense, and should, therefore, no longer be under the control or domination of other factors of less importance."

J. Carroll Cone,
Command-Aire, Inc., Little Rock, Ark.

An Ardent Reader Until Recently

"I have until recently been an ardent reader of Popular Aviation. I found Popular Aviation one of the best aeronautical magazines to date. Its several departments, each educational as well as interesting, have increased Popular Aviation's great number of readers throughout the United States.

"The other day as I was as usual going to get my issue at our local news stand, I noticed a magazine cover, with the familiar heading inscribed, Aeronautics, *Formerly* Popular Aviation. At first I thought I was looking at a Ladies' Home Journal or a Saturday Evening Post. Anyway, that cover on your July issue looked as if your cover artist had had a serious attack of sea-sickness the day he drew that drawing.

"Popular Aviation has been my choice in all aviation magazines. But Popular Aviation does not exist now, it is Aeronautics, a magazine similar to any other aviation magazine."

Frank R. Chavez,
Oceanside, California.

Sixty Percent too Tempestuous

"As a military man I heartily endorse the plan for a separate National Academy, and I believe that it is a logical step toward a Department of National Defense which is certain to come in the not far distant future. As a matter of efficiency, economy and coordination of the defense arms the nation must have such a department. It is only a question of time until we do have it.

"I would advocate careful study and planning of both. General Mitchell is about 85 percent right and 15 percent wrong and certainly some 60 percent too tempestuous. For example, as I recall his comments on the air-cooled motor, he was far from right. Yet above all I admire his courage and efforts if not the way in which he sought to carry out his plans."

Lawrence G. King,
Aviation Editor, Detroit Times.

Brilliantly Logical

"Your suggestion of a National Air Academy is brilliantly logical. An academy must develop."

Myron Weiss,
Time—The Weekly Newsmagazine.

The National Air Academy

"Personally, I fail to see any particular need for it, as both the Army and Navy have entirely different spheres to cover, and it is very important that the aviation branch in both departments be thoroughly trained, not only to co-operate, but to understand the problems that affect each branch.

"The Army already has a splendid plant at Dayton, as well as several other good training fields, while the Navy is teaching the ground work in the academy, and advanced flying at San Diego and Pensacola. To establish a National Air Academy would merely duplicate the work being performed by both branches of the service, and would add considerably to the tax burden we are now paying for present and past military expenditures.

"As an ex-Army officer, with three brothers who have been in the Navy, I am more or less familiar with the operations of the aviation branch of the services, and believe, in spite of all our friend General Mitchell says, that our present system is plenty good enough."

John L. Hamilton,
International Derrick and Equipment Company, Ex-Captain, A. E. F.

An Influx of Trained Executives

"Many people lose sight of the fact that from Annapolis and West Point have come, not only eminent naval and land force commanders, but great business executives, trained to give orders and to see that they are executed properly.

"What greater boon could Aviation win for itself than an influx of trained executives from a National Air Academy; men who know what they are talking about so well that they can go out and do it themselves.

"Such a group would do the country and Aviation a double good. They would become peace-time promoters of a more rapid aerial progress, and constitute a remarkably strong air reserve force for wartime to swell and expand the constant group that would make military air service a career."

C. O. Davis,
Aircraft Finance Corporation of America.

Sometimes They Teach a Lesson

"Referring to page 83 of the July issue of Aeronautics it occurs to me that a photograph of the author of the story, standing beside his ship *before* it had been burned up, would probably have been a little more suitable as a heading for the story.

"The article itself is, I think, excellent as a very good piece of descriptive writing."

C. H. Biddlecombe,
Wright Aeronautical Corp., Paterson, N. J.

Should Have the Same Prestige

"Your suggestion that aeronautics be put on its own feet and divorced from the Army and Navy is well taken. If such a step were taken it seems to me that the direction and decision on matters applying to aeronautics would be much more effectively handled, as there would be no working at cross-purposes by the various branches affected, as is now the case with military aeronautics, naval aeronautics, marine aeronautics, etc. There is no reason in the world why aeronautics should not be given the same prestige the Army and Navy now enjoy, and receive the same co-operation. The Army and the Navy now co-operate in non-defensive and defensive matters, and there is no reason in the world why the Department of Aeronautics, if organized, cannot function just as smoothly in its relations to the other two departments."

John C. Nulsen,
Ryan Aircraft Corporation,
Anglum, Mo.

Not Without a Separate Air Force

"In commenting on the editorial 'Shall We Have a National Academy,' we feel that we are not in a position to know all the military aspects of this question. However, it does seem to us that if this country should develop an air force entirely independent of the present Army and Navy, an academy of this kind would undoubtedly be a necessity.

"If a separate air force is not undertaken we believe that a National Air Academy would not be of particular advantage in addition to the present Army and Navy schools at Brooks and Kelly Fields, and Pensacola.

"There is no doubt, from a commercial standpoint, that a school of this sort would be of inestimable value in times of peace, and even more so to our country in times of war.

"We congratulate you on keeping alive vital problems of national interest."

Edgar N. Gott,
Keystone Aircraft Company,
Bristol, Pa.

A Forum of Comment, Criticism and Remarks by Our Readers

Commerce and Defense Go Hand in Hand

"Commercial aviation and the development of airplanes for national defense go hand in hand. On the other hand, there is little or no benefit to peace-time commerce derived from the expenditures made upon the other two branches of the national defense—the army and navy.

"Thus from an economic as well as a patriotic viewpoint, there is a good reason for the establishment of a national air academy.

"Men trained in such an academy, similar to West Point and Annapolis, would be fitted to occupy not only the most important positions in a national department of aviation, in time of war, but they would be equipped to lead in the building and development of commercial air lines in time of peace.

"They would constitute a reserve force, similar to the naval reserve, whose members man ships of the merchant marine in time of peace but are quickly available for service as part of the national defense if war should break out.

"Acting in cooperation with and under the sponsorship of the chief of the U. S. Army Air Force, the General Tire and Rubber Company has just sent a fleet of eight cabin monoplanes on a nation-wide tour to aid in the development of commercial aviation and to demonstrate the availability of commercial aircraft for conversion into ships for national defense in time of war. Each of the planes is manned by a former army flier, trained at Kelly and March fields, and stationed at Selfridge field, Michigan, as members of the First Pursuit Group.

"Properly trained pilots, of the highest type, constitute one of the greatest needs in aviation, both commercial and federal, today. Establishment of a national air academy, in which such men could be fitted for the greater tasks that are ahead of aviation in the near future, would insure not only that commercial aviation would take great strides forward but that our nation would be better fitted to defend itself, in case of war, by means of trained airmen, responsible to a separate air ministry."

W. O'Neil,
President, General Tire & Rubber Co., Akron, Ohio.

A Constructive Plan

"Your firm stand and constant efforts in behalf of the development of a National Air Academy will go far toward making your paper the greatest in the aeronautical industry. The following thoughts are the consummation of many years of contact with the aeronautical industry and six years' participation in the United States Army, including three active campaigns and familiarity with the training methods used by a majority of aeronautical schools, as well as the Air Corps and other special branches of the Army and Navy.

"Our National Air Academy should be an institution thoroughly equipped and designed to develop the highest caliber of officers for continued services in the Air Corps of our country in accordance with the highest ideals and standards and with the principles and successful formulæ used at West Point and Annapolis.

"The students for the National Air Academy should be drawn, first, from Congressional appointment; second, from men of exceptional ability in aeronautics at our Universities; third, by invitation from the Governing Board of the Academy to any man between the ages of 16 and 36 who shall by his own work for the promotion of aeronautics have demonstrated himself to be of exceptional value to our Government.

"The instructors of the Academy should include specialists from both commercial and military fields, in order that the rigid dogma and superlativeness of mind of some of our Government graduates be kept from this new National Air Academy.

"The Board of Governors should be composed of a representative from the General Staff of the Army, one from the General Staff of the Navy, a representative of the Secretary of Aeronautics (which it is presumed will be created in the near future), one from the Council of National Defense, one from the National Aeronautical Chamber of Commerce (elected at large and not a paid official of the Chamber), a representative from the National Aeronautical Association (to be elected as above), and a representative from the American Bankers' Association.

"The location of the National Air Academy should be, must be absolutely in the center of the country, as far as possible from all boundaries and, as it will be the center of a great amount of experimentation, it is, therefore, suggested that this Academy be placed at or near Wright Field, Dayton, Ohio, with headquarters also at Belle Isle or Chicago."

Jack Whitaker,
Szekely Aircraft & Engine Co., Holland, Mich.

Clean and Practical

"We hope to see more editorials on this order. Your magazine has always impressed me a great deal. I know that the success you are enjoying is entirely based on the clean and practical information that is given to the public."

A. W. Seighff,
Zenith Mfg. Corp., Milwaukee, Wisc.

Spasms of Mental Ankylosis

"Your editorial in the August issue of Aeronautics on the desirability of a National Air Academy should meet with the approval of every American barring only the official bureaucrats, who always have and always will suffer a spasm of mental ankylosis when any constructive readjustment is proposed.

"Practically all great progressive achievements have been realized only after years of struggle against the usual candid but woefully atavistic opposition on the part of those in power.

"I believe that your editorial is absolutely sound in its logic and that its purpose will ultimately be realized. I believe that the time required will be less than for many other equally worthy readjustments made in the past. All things aeronautical appeal to the public imagination and seem to sell themselves with rare success. This fact means a great deal to the success of the movement. Keep hammering along this line and results will be assured and not far in the future."

L. S. Sweet,
The Kenyon Press Publishing Co., Wauwatosa, Wis.

An Ace Speaks Up

"I am most completely in accord with your proposal that such an air academy should be set up. I am just as soundly sold on the importance of air power as differentiated from air service.

"After working six or seven years on the subject at Washington and other parts of the United States, I believe the answer is the formation of a department of national defense combining all arms rather than further separation.

"I believe the wise old men who wrote our Constitution meant to have that kind of an organization when they made the President of the United States Commander in Chief of its armed forces. In each of their minds was a picture of George Washington as a typical president. They did not possibly conceive the great mass of presidential duties which now make it an impossibility for the White House incumbent to function in fact as Commander in Chief. It seems to me that we should be meeting the intent of the Constitution therefore, and certainly the dictates of sound business as well as proven military strategy if we place the command of all of our armed forces in one place where a big stick could be swung at the head of any gentleman who got in the way of the progress of the whole show.

"I believe that such a merger should properly be built around under-secretaries for land, sea, air and procurement, with one general staff—really general—and with all types of forces available to be used as that staff thought most efficient. I believe such a co-ordinated department more desirable than further separation and most easily attained."

Reed G. Landis,
Reed G. Landis Company, Chicago.

High Flying—

By Betty Huyler

As day after day of this glorious summer flying weather passes by we find sport flying becoming more and more popular throughout the country. We find that the interest of the general public is steadily increasing, that ships are being used for almost every purpose connected with both business and pleasure, and that communities are at last beginning to realize the value of maintaining airports of their own. Added to this is the fact that all those who are in a position to own ships themselves are constructing private landing fields on or near their estates which may be used to great advantage not only by themselves but likewise by their many flying friends.

Hitherto the greatest drawback to sport flying was the lack of landing facilities. Flying had to be restricted to the immediate vicinity of the airport, and this consequently set great limitations on the advantages of cross-country flying. On the other hand, we find today innumerable men and women who use their ships for such purposes as "going over to the Golf Club," "going up to the races," or "going away for a week-end house party."

The formal opening of the Long Island Aviation Country Club is of interest in the promotion of social flying. The Long Island Club, situated at Hicksville, L. I., was opened recently, and the ceremonies were attended by some eighty or more of the most prominent figures in aviation as well as many well-known visitors from distant parts of the country. Among those of note who flew to the dedication were F. Trubee Davison, Assistant Secretary of War for Aviation; David S. Ingalls, Assistant Secretary of Navy for Aviation; Admiral William Moffett, Chief of the Naval Air Service; Fred B. Rentschler, President of Pratt & Whitney Aircraft Company; H. N. Whittelsey, President of Whittelsey Manufacturing Co.; Col. B. F. Castle, President of the Great Lakes Aircraft Corporation; Major R. W. Fleet of the Fleet Aircraft Corporation; Edgar N. Gott, President of Keystone-Loening Airplane Co.; Minton M. Warren, President of Moth Airplane Co.; Col. Robert R. McCormick, President Chicago Aviation Country Club; Walter Beech, President Travel Air Manufacturing Co. Others who flew were William B. Mayo, Archibald Johnston, Eric Wood, Mrs. Darwin J. Adams, George B. Post, Howard Pitcairn, President of Pitcairn Aviation, Inc., George Pynchon, Fred Lund, Stewart Kilbourne, Jack Whitaker, Frank H. Jerdone, W. R. R. Winans, and Archibald B. Johnston. Others of social prominence who were found among the spectators were Mrs. Robert Powell, Mrs. William Barclay Harding, Mr. and Mrs. J. Russell Lowell, Mrs. W. M. Lovejoy, Mrs. Varick Stout, Mr. Grover Loening, Mr. Albert P. Loening, Mrs. Charles L. Lawrance, Mr. and Mrs. Warren Pond, and Vicomte and Vicomtesse Jacques de Sibour.

Mrs. Mary C. Alexander

It was truly a remarkable assemblage which witnessed the opening of the Club, and one which in itself demonstrates the popular interest in sport flying. And in the same manner, we find this interest increasing throughout the country. The Aviation Country Clubs, Inc., are organizing a nation-wide chain of these clubs, numbering one hundred fourteen or more, which will extend from coast to coast, and at each one of these, club members will find a hearty welcome.

A new flying field has just recently been opened at Newport, R. I., due to the activities of Major Lorillard Spencer and William H. Vanderbilt. Heretofore, those who commuted by plane from New York were forced to land on the Country Club golf links, and there are a great many who take advantage of this means of transportation. Now, however, a model airport is being laid out near the city limits which will greatly facilitate commuting by air. Though Newport seems a long way from New York City, it takes only one hour and twenty minutes by plane, as was demonstrated by Carrol Dana Winslow, who made the initial flight. Recently Miss Ruth Jones and Jean G. Dary were the guests of Mr. Frazier Jelke, who flew them up from New York in his Amphibian, entertained them at Eagle's Nest, and returned with them to New York by plane.

Miss Nancy Hopkins (left) and Miss Candiss Hall

One of the most unusual and unique affairs in connection with social flying took place at the Newark Metropolitan Airport on July 11. This was the formal christening party of the new airplane recently purchased by Mrs. George F. Kunz. Mrs. Kunz is socially prominent in New York society as the wife of Dr. George F. Kunz, vice-president of Tiffany & Co., and international gem expert.

The ship, a trim J-6 Travel Air, replaces one of lesser power which was wrecked last month near Morristown, N. J.

About three hundred persons attended the christening party which took place in the Newark Air Service Hangar. Mrs. Thomas A. Edison, who was the guest of honor, bestowed the name of Betsy Ross on the ship with the aid of a bottle of ginger ale. Many other prominent

(Continued on page 42)

THE · · · BARLING NB3 · BREAKS·TWO·MORE·RECORDS·

American Altitude Record for Light Planes

World's Non-Stop Record for Light Planes

Already firmly established as the world's foremost light plane, the Barling NB3 has added further to its prestige by breaking the two most important records in aviation.

On May 28th, at St. Louis, the NB3 broke the American Altitude Record for light planes by attaining a height of 20,862 feet.

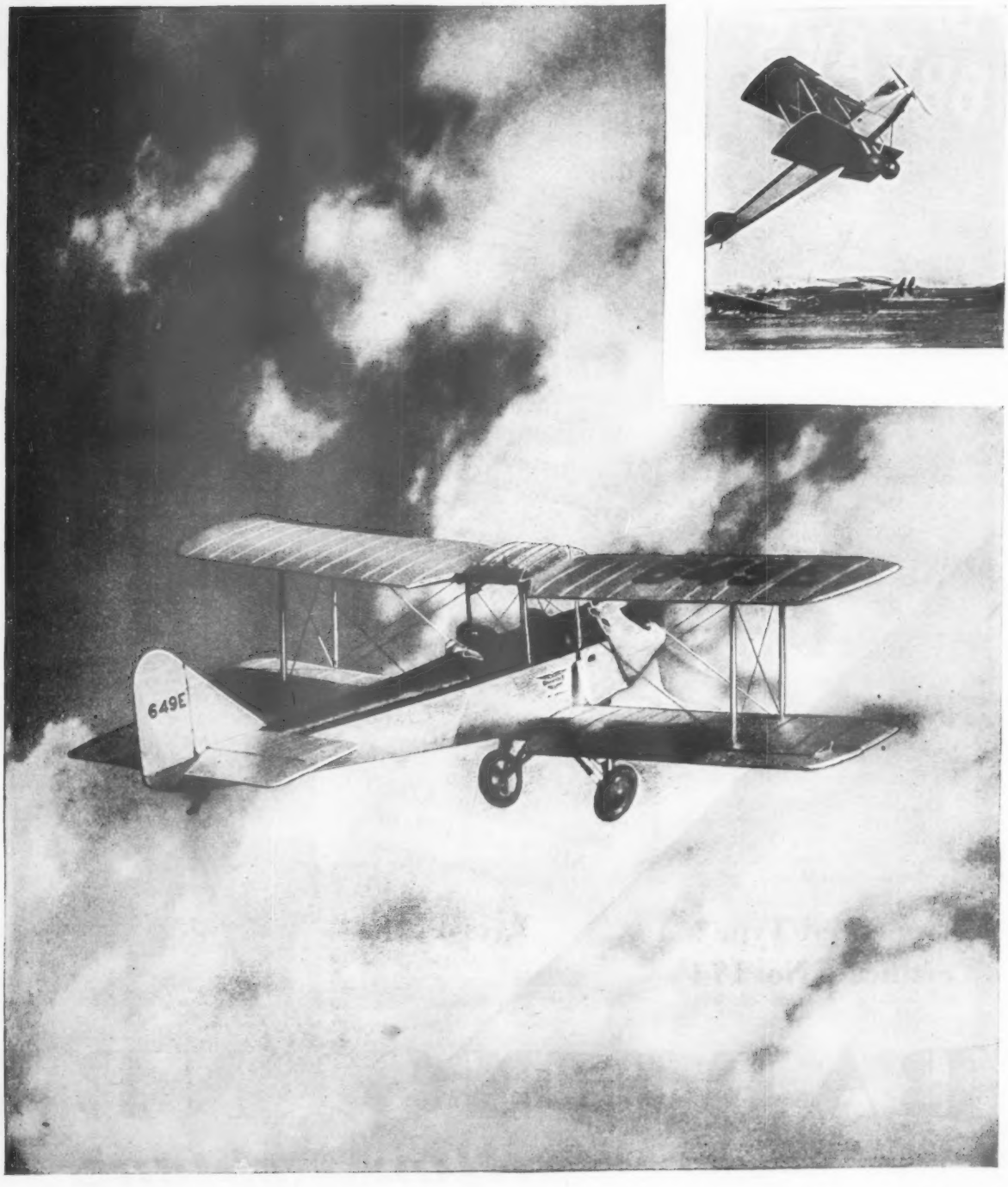
On July 7th the NB3 captured the world's light plane non-stop flight record by flying from Brownsville, Texas, to Winnipeg, Canada—a distance of 1,650 miles, *in sixteen hours.* Over one hundred miles per hour for sixteen hours in a plane equipped with a Le Blond sixty horse power motor! The identical duplicate of this record-breaking plane—for $3,600 at the factory.

NICHOLAS-BEAZLEY AIRPLANE CO., Inc.
Manufacturing Division
MARSHALL, MISSOURI

Approved Type Certificate No. 174

BARLING NB 3 Monoplane

Right off



THE OUTSTANDING SPORT AND

the old front porch

. . . it's the light plane for training and sport

IF there's any light plane that measures up to the requirements of the flying instructor and the flying sportsman, it's this ship that has left in its wake a string of records and years of air miles as a training, club, and touring plane.

In its uncanny ability to put the horizon between its wheels and the ground in a very short distance, the Avian gives the experienced pilot something to think about. But unusually quick take-off is only the prelude. Put the Avian through its paces. Fly through all sorts of weather. Experience the difficulty of intentionally spinning the ship—and her prompt automatic recovery upon simply releasing the controls. Float in to a landing . . . You've never flown a ship more successful in keeping a level course. Spins are not in the bag. For the genius of designing has given this famous light plane the capacity for a remarkable flying performance and a generous safety factor of 8. Added to the inherent safety and stability of the Avian, Handley-Page wing slots are standard equipment. They help to prevent spins and slips, lower stalling speed and decrease landing speed.

Famous in Europe

As a training plane, as the plane flown by record-making pilots the Avian is famous in the flying circles of Europe. It is popular as a club plane. Sportsmen use it for touring because it is economical, easy to handle, sturdy and not temperamental.

Yet dependability has not dimmed performance. The Avian has the speed, the airworthiness necessary to achieve records. Witness: Fastest time England to Australia . . . first solo flight between these two countries . . . fastest time England to India . . . first non-stop flight London to Rome.

Now It Rides America's Sky-Lanes

Under sole royalty rights the Avian is now being produced in this country as the Whittelsey Avian. It's the same ship with a different name.

It offers the flying instructor the opportunity to turn out skilled flyers in fewer hours, with less expense and without the hazards that usually attend the task of teaching a fledgling to fly. Its upkeep is low-keep. Easy to maintain. Economical in the air and on the ground.

And the man who wants to fly his own ship, either for business or pleasure, will find in the Whittelsey Avian everything that he can desire. Speed and durability. Safety that no other light plane can approach. Sturdiness. Quickness in take-off as well as ease in landing.

Here Are Its Specifications

Power Plant: Cirrus Mark III, 95 H.P. air-cooled, four-cylinder in-line aircraft engine. Famous for economy of operation and maintenance. Top overhaul at 200 flying hours. *Economy of Operation:* 20 miles to gal. of gas . . . 500 miles to gal. of oil . . . *Speed:* Maximum, 102 m.p.h.; cruising, 85 m.p.h. . . . landing, 35 m.p.h. . . . *Ceiling:* 18,000 feet . . . *Cruising Range:* 5 hours or 430 miles . . . *Weight:* Light, 875 lbs. . . . *Aerobatics:* 1450 lbs. . . . Top, 1600 lbs. . . . *Dimensions:* Wings span, 28 ft.; Width folded, 9½ ft. . . . Height Overall: 8½ ft., length overall, 24 ft. . . . *Price:* Only $4995, Flyaway or F. O. B., Bridgeport, Conn.

It Sells on Performance

It is doubtful if there is any light plane better adapted to every day flying needs. Certainly there is no light plane more economical and safer to fly, easier to maintain. And the Whittelsey Avian performs every evolution, meets and conquers every obstacle with the ease of a born aristocrat.

There's Money To Be Made

National distribution of the Whittelsey Avian is being completed. Representation in some of the leading aviation centers of the country is being arranged. Interested and responsible parties are invited to write for further information concerning our sales plan.

Whether interested in the Whittelsey Avian as a flying school head or as a sportsman, write us and we will gladly send you complete and detailed information concerning this famous light plane. Dept. E-2, Whittelsey Mfg. Company, General Office and Plant, Bridgeport, Conn.

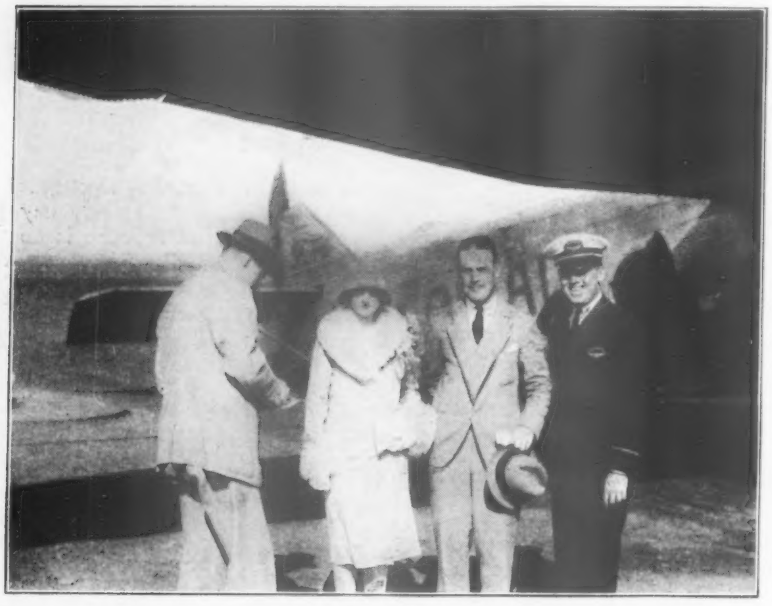
A.V.R.O. AVIAN
In England

WHITTELSEY AVIAN
In America

TRAINING PLANE OF THE WORLD

men and women were present—among them Rear Admiral Louis R. de Steiguer, Elmer A. Sperry, Colonel E. H. Hartney, Miss Rose Bullard, Mrs. Hanson E. Ely, Paul Gadabush, Arthur Brooks, Capt. James A. Waugh, Mrs. Hugh A. Drum, Commander W. R. Pierce, and George P. McLaughlin.

It was truly a gala event. The pilots of the airport were all attired in evening dress, and thusly attired, piloted many of the guests on sight-seeing trips over New York and vicinity. Music was provided by an Hawaiian orchestra in the hangar, and a delicious buffet supper was served. How well this demonstrates the vast interest which society is taking in aviation!



JUST MARRIED
Mr. and Mrs. Thomas Crimmins Burke and H. W. Farris, pilot of the Boston ship

Of note among the students at Roosevelt Field, L. I., this summer we find Mrs. Mary C. Alexander of Lynchburg, Va. Mrs. Alexander is learning to fly in order to be able to assist in the promotion of aviation in Virginia. She is particularly interested in awakening the interest of the women of her state and proving to them that even those who have responsibilities can and should fly, as well as drive automobiles. Mrs. Alexander is the mother of two children, Jack, sixteen years old, and Mary, thirteen. "I have no intention of attempting an endurance flight, of stunting, or of making spectacular flights," she asserts. "My sole aim is to promote aviation in Virginia."

Two more prominent society girls have recently joined the ever-increasing ranks of women pilots. Miss Candiss Hopkins, son of Dr. and Mrs. Samuel Hopkins, of Brooklyn, N. Y., and Hubert O'Brian, son of Mr. and Mrs. P. B. O'Brian of Detroit, have both become efficient pilots and are steadily getting in their "time" for a transport license.

And now we come to "the Commuters." Famous among these we find Mr. Samuel B. Lambert of St. Louis. Mr. Lambert takes off from his home every morning, flies to his office two hundred four miles away at Moline, Ill., and returns home in the evening. When we think of that distance, commuting seems absolutely out of the question. And yet within two hours after Mr. Lambert leaves his home he is sitting at his desk in his office. Just think of the millions of people who commute daily to New York on the railroad from their homes not more than forty miles from the city, and what a great percentage of them spend more than two hours en route on trains, ferries and subways.

Mr. Richard F. Hoyt commutes by plane not only from his house-boat at Port Washington but also from his home on Buzzards Bay, Massachusetts. His ship, a Loening amphibion, makes the trip from Buzzards Bay to New York, a distance of one hundred eighty miles, in one hour and a half, and from Port Washington in less than twenty minutes. Compare this with the time required if traveling by automobile—forty-five minutes from Port Washington to New York, and at least six hours from Buzzards Bay to New York.

Mr. John W. Gillies, Jr., General Manager of the Mercer Pottery Co. at Trenton, N. J., uses a Curtiss Robin to commute to his home at Stony Point, N. Y. Mr. Gillies takes off from the Mercer Airport at Trenton and one hour and five minutes later he arrives at his private field a mile from his home at Stony Point. By train it would take Mr. Gillies four hours to make the trip, and by automobile three hours at least.

How well this proves the value of aviation to the business man!

Recently a great event took place in New York society. This was the marriage of Miss Helen McManus to Mr. Thomas Crimmins Burke. And connected with this event we once again find aviation playing an important role. It seems that immediately following the ceremony, which took place at the church of St. Ignatius in New York, the bride and groom slipped away and headed for the Newark Airport. But no sooner had they left than Mr. Joseph Amy, best man, Gregory Burke, brother of the groom, and Mr. Frank Carroll, an usher, were on their trail. However, as the story goes, this trio were held up just one minute too long in traffic, for when they finally reached the airport they beheld the giant tri-motor Ford just soaring up into the air, carrying Mr. and Mrs. Burke away to Boston. The pursuers spent no time in regrets but chartered a ship and caught the pair before they sailed from Boston.

Captain John Donaldson with Mrs. George F. Kunz

Introducing the Wallace Touroplane..... the latest addition to the Famous AMERICAN EAGLE line

MASTER OF THE SKIES

Another great new model now takes its place in the world-famous American Eagle line—the Wallace Touroplane—built by the Wallace Aircraft Company, Inc., a division of the American Eagle Aircraft Corporation.

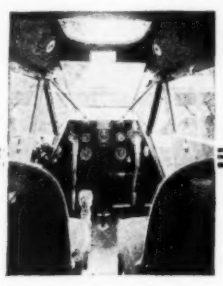
The Touroplane is one of the most stable monoplanes ever built. It has folding wings, dual side-by-side controls, brakes, cabin heat, and many other features which place it far ahead in its field.

The construction of the Touroplane is everything that the most skillful builders of modern aircraft can make. Its comfort and the luxury of its appointments can only be compared to a fine motor car.

Its performance will amaze you! The Touroplane attains a cruising speed of 100 miles per hour—a maximum speed of 115—a climb of 800 feet per minute. It is exceptionally economical to operate.

The Wallace Touroplane offers you all this at a price far lower than other fine planes of its type! Fully equipped and powered with Kinner 102 H. P. Engine, the Touroplane is priced $5,795, fly-way Kansas City.

American Eagles may be purchased now on a surprisingly convenient time payment basis. Write The American Eagle Aircraft Corporation, Department A 9, Fairfax Airport, Kansas City, Kansas, for full details.



LUXURIOUSLY UPHOLSTERED CABIN
3-Place, dual side-by-side control; folding rear seat; heater; Safety glass; perfect visibility from every angle. The wings may be folded by two men in six minutes, and the Touroplane parked in an area 13x25 feet.

We are eager to show you this remarkable new model! See your nearest American Eagle dealer and have him demonstrate the Touroplane to you. Or write or wire to us for complete literature and information.

Valuable territories are open to well-qualified distributors.

AMERICAN EAGLE
AIRCRAFT CORPORATION
FAIRFAX AIRPORT KANSAS CITY, KANS.

3-A

Aerodynamics

Illustrations by the author

Alexander Klemin
College of Engineering, New York University

Take-Off and Climb

During the take-off run there are the following forces acting on the airplane:

1. The thrust of the propeller pulling it forward.
2. The inertia of mass of the airplane resisting acceleration.
3. The friction of the ground.
4. The aerodynamic resistance or drag of the airplane.

It is the object of the pilot to make as quick and short a take-off run as possible, and we shall discuss the measures he can adopt to this end.

Take-off on Smooth Ground

The coefficient of ground friction on smooth ground is generally less than .05, so that the ground force is less than one-twentieth of the weight resting on it.

Since the lift over drag ratio of an airplane is far less than twenty, it follows that on smooth ground there will be less total resistance (ground friction and air drag) during the take-off run, if the airplane is supported more by the ground than by the lift of the wings.

In fact theory and experiment both show that the best way to get up speed is to place the wing in "flying position" when it has little lift but also little drag, with the tail up.

Besides, where a tail skid is employed, the drag of the skid increases the resistance very much.

Therefore the pilot endeavors to raise the tail as quickly as possible, by depressing the elevators.

On a modern machine, with powerful engine, and the elevators in the slip-stream of the propeller, it is possible to raise the tail very quickly (even if the center of gravity is well back of the wheels, as is the case where wheel brakes are employed).

When the airplane is once in the flying position as illustrated in Fig. 1, the control stick must be eased back, and the elevator brought back into almost neutral position, otherwise the turning moment of the elevator may bring the machine over into a position where the propeller strikes the ground.

Take-off on Rough Ground

If the ground is rough, and the ground friction high, then it is advisable to raise the tail skid only slightly and to keep the wings at a high angle of incidence and lifting as much as possible.

If the airplane has been put into "flying position" and this position is correctly maintained the airplane will eventually lift itself off the ground without further intervention by the pilot.

The airplane should then be held level two or three feet off the ground, until an additional reserve of speed is attained. Then the nose of the plane is raised gently until the best climbing attitude is obtained.

Of course when the airplane lifts itself off, in flying position, with a small angle of incidence, the lift coefficient is less than the maximum. Therefore the speed of take-off will be higher than the stalling speed.

The pilot can leave the ground at only a little above stalling speed, by raising the nose after he has attained a fair speed. He will then get off the ground more quickly than by the automatic, flying position method.

The question arises as to why raising the nose to leave the ground is not the better method.

The answer is that he will then take to the air at only a little above stalling speed, the excess horse-power will be small, and the climb very poor.

Also climbing near the stalling speed may readily lead to stalling itself, which as we have stated previously may lead to serious difficulties.

Smooth ground will naturally help take-off.

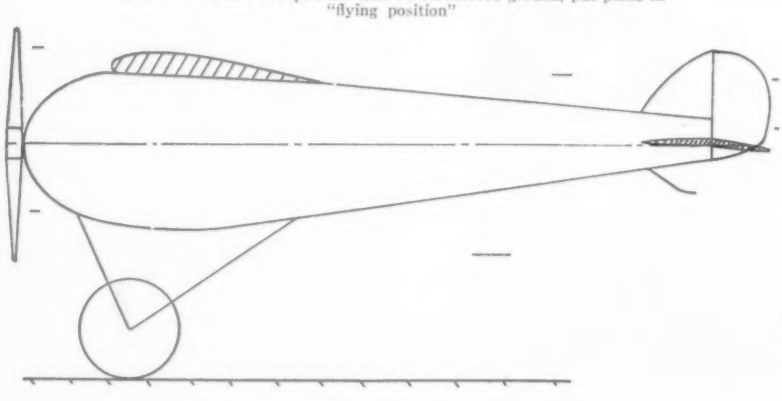
So will a "clean" airplane which has low resistance during take-off.

Low weight per horse-power will of course give a large propeller thrust for a given weight of airplane. Designers cannot always employ a low weight per horse-power because other factors such as pay load, cost of engine and fuel enter into the problem.

Low loading per square foot of wing area gives low minimum flying speed, and a low climbing speed. Therefore low wing loading will help the take-off considerably. Low loading per square foot means of course a reduced top speed and entails other disadvantages.

The variable pitch propeller, when made thoroughly practical, should be of real help on the take-off. For high speed, a high propeller pitch is necessary. To get the maximum thrust

Fig. 1—To make the quickest take-off on smooth ground, put plane in "flying position"



School and Training Information

Those contemplating attending aviation schools may obtain from Aeronautics complete information on aviation schools anywhere in the United States. No recommendations or comparisons between schools will be made but sufficient information as to the equipment, personnel and courses offered will be given so that students can readily make their own selections.

"Be Travel Air Minded"

Over Eleven Hundred ships delivered to purchasers is a talking point of significance.

Air Lines Everywhere using and others adopting this proven "limousine of the air" again is significant of unexcelled value.

Nation-wide Distribution and service is further assurance of public acceptance.

It's Wisdom to Know Travel Air.

TRAVEL AIR COMPANY

WICHITA, KANSAS

The Standard of Aircraft Comparison

Send for The Story of Travel Air (new edition) free on request—illustrates and describes three types of dual control cabin monoplanes and eight types of open cockpit three-place biplanes—also takes you through the Travel Air factory with illustrations and full description of manufacturing.

at take-off, the pitch should be as low as possible. In a fixed bladed propeller the two requirements are contradictory; the variable pitch propeller reconciles them.

Taking Off into the Wind

Flying instructors insist quite rightly that take-off should always be made into the wind.

If an airplane which takes off at a normal air speed of 45 miles per hour, heads into a wind of 20 miles, the ground speed at take-off will only be 25 miles an hour. Therefore heading into the wind, the acceleration needed is less, and there is less work in overcoming ground friction. A take-off into the wind is therefore both quicker and shorter than in calm air. Fig. 2 illustrates the way in which the length of take-off varies with a head-on wind. It is strange to think that if the wind speed is equal to the normal take-off air speed, the airplane need not run along the ground at all before getting into the air.

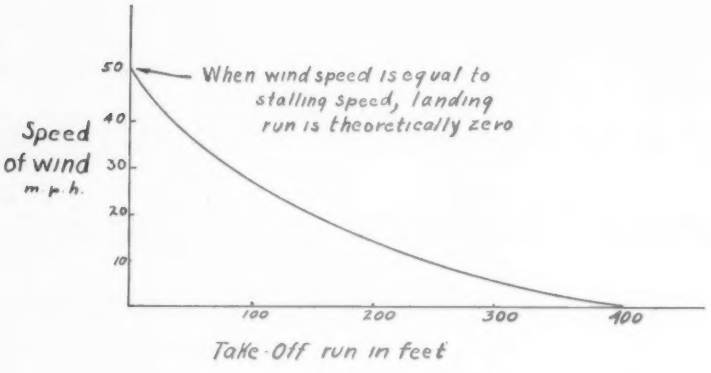


FIG. 2—How length of take-off varies with head-on wind

Also when taking-off into the wind the relief from the lift of the wings is much greater, and bumpy ground produces less shocks.

Even if there is a head-on wind for take-off, careful pilots take all the run they can get, as a precaution against possible difficulties, and are likely to taxi to the very end of the flying field, on the leeward side. It is only in passenger hopping where flight after flight has to be made rapidly that this rule is sometimes unjustifiably broken.

Conversely, if taxying with the wind, the ground speed at take-off is higher, and the landing roll longer. Moreover, no relief of the weight of the airplane is possible from the lift of the wings until a ground speed higher than the windspeed is reached. Shocks between wheels and ground are high and unpleasant riding follows.

Best Climb

From the curves of power available and power required given in Article 6, it can be seen that there is one air speed at which the excess horse-power (that is the difference between power available and power required) is a maximum. The best climb occurs at this air speed. Some experimental flying is needed before the best air speed for climb can be determined. A practical rule for determining best climbing speed is:

$$\text{Best Climbing Speed} = \text{Stalling Speed} + \frac{1}{3}(\text{Top Speed} - \text{Stalling Speed})$$

Steepest Climb

There is a distinction, which is often forgotten, between best climb and steepest climb.

Best climb is the highest rate of vertical ascent. Fast climb is particularly important for military machines, because a fighting craft must be able to ascend rapidly to great heights to out-maneuver an enemy.

Steepest climb is not the most rapid climb but the climb at the greatest angle to the horizontal. For commercial airplanes, particularly when required to get out of fields surrounded by obstacles, ability to climb steeply is perhaps more important than rapidity of climb.

A fast military airplane of low loading per horse-power and high loading per square foot will climb much faster than a slower commercial machine of low wing loading, but not as steeply.

In the steepest climb an airplane is capable of, the excess horse-power and the rate of climb will both be less than at best climb, but the air speed will be less also.

Climbing with and Against the Wind

We have seen what importance the direction of the wind has in take-off. On the climb, particularly when clearing obstacles surrounding a field, it is equally important to head into the wind.

The path in space of an airplane is given by the geometrical resultant of the speed relative to the air and of the speed of the wind itself.

When climbing against a head wind the rate of vertical ascent at a given air speed is precisely the same as in calm air. But a horizontal velocity relative to the ground is decreased. Hence the path in space is steeper. Conversely when there is a following wind, the path in space is less steep.

Example

1. The hypothetical airplane of Article 6 has a gross weight of 1600 pounds. At 90 miles an hour, the excess horse-power is 41.7 horse-power. What is the rate of climb? What is the angle of climb?

The excess horse-power goes into work against gravity.

$$\text{Therefore rate of climb in feet per minute} = \frac{\text{excess power in foot pounds per minute}}{\text{gross weight in pounds}} = \frac{41.7 \times 33{,}000}{1600} = 861 \text{ feet per minute}$$

The speed along the flight path in feet per minute is

$$90 \times 1.47 \times 60 = 7920 \text{ feet}$$

Therefore as illustrated by Fig. 3,

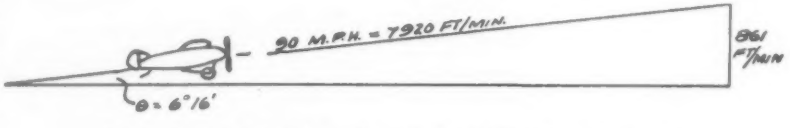


FIG. 3—A plane having air speed on the climb of 90 miles per hour has a rate of climb of 861 feet per minute. The angle of climb is 6°-16′

Sin θ, where θ is the angle of climb is

$$\frac{861}{7920} = .109$$

and the angle of climb is approximately 6° 16′ as can be ascertained from a table of natural sines in any book on Trigonometry.

2. If the airplane of the previous example is flying against a horizontal wind of 20 miles an hour, what will be the steepness of the path in space?

Up and away in a flash . . . easy on the controls . . . 120 and better, with full load . . . steady and smooth . . . asking no favors of landing fields . . . the WACO "165" is a great ship to own.

SOUND DESIGN... the heritage of WACO "165"

A *good* airplane is not born full-fledged. It requires "seasoning." It must be refined and perfected through practical service.

Sound design is the heritage of the WACO "165." In its every detail, it reflects the advantages of WACO'S past experience and success . . . the many hundreds of WACOS which have preceded it.

That's why WACO "165" performance is satisfying and dependable . . . why "165" value is unmatched in its class.

Let us send you the new booklet that gives facts and figures about the WACO "165." And if you wish, we shall be glad to refer you to the nearest one of the nearly 300 WACO dealers.

THE WACO AIRCRAFT COMPANY, TROY, OHIO

SPECIFICATIONS WACO "165"

J-6 Wright "Whirlwind" motor (165 H. P.—5-cylinder) . . . Bendix brakes . . . Navigating equipment . . . 65-gallon gas tank . . . 3-place . . . Dual controls . . . Customer's choice of colors $6370

With metal propeller, $6645

U. S. Dept. of Commerce Approved Type Certificate 168

WACO AIRPLANES

"ASK ANY PILOT"

As illustrated by Fig. 4, the rate of vertical ascent will remain unchanged.

The horizontal component of the air speed is

$$7920 \times \cos 6° \ 16' = 7920 \times .9974$$
$$= 7900 \text{ in feet/minute.}$$

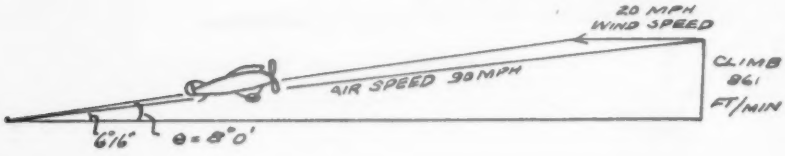


FIG. 4—Climbing against a head wind, rate of climb is unchanged, but path in space is steeper than in calm air

The wind velocity in feet per minute is

$$20 \times 1.47 \times 60 = 1760 \text{ feet.}$$

Therefore the resultant horizontal velocity is

$$7900 - 1760 = 6140 \text{ feet per minute.}$$

If θ is the angle of climb in space,

$$\tan \theta = \frac{\text{rate of ascent}}{\text{resultant horizontal velocity}} = \frac{861}{6140} = .141$$

and θ is now 8° 0′ which is considerably steeper than in calm air.

Fig. 5 illustrates the effect of head and following wind on the climb, and shows that when climbing against the wind surrounding obstacles can be cleared much more readily.

Stalling on the Climb

We have stated that a steeper angle of climb can be achieved by using an air speed, somewhat less than that of the best climb. It is not advisable, however, to climb at speeds approaching stalling speeds. The excess power then available is small, and if the angle of incidence is increased either by a movement of the control stick or by a gust of wind, a stall may follow. With the engine still functioning recovery is fairly easy.

A more dangerous case is when the engine suddenly fails on a steep climb. With the engine out of commission the natural flight path in space is downward, whereas the nose of the plane is at a large angle above the horizontal. Therefore the angle between the wing and the flight path becomes very large (as shown in Fig. 6) and a violent stall may ensue. We shall consider later in more detail the phenomena involved. It is sufficient for the time being to state, that if the engine fails on the climb, the proper thing for the pilot to do is to push forward on the stick, and try to bring the nose down, so that the wing is brought to a smaller incidence relative to the flight path, and push straight forward.

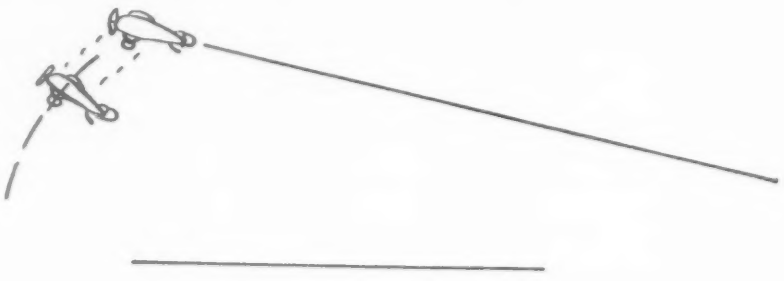


FIG. 6—When the engine fails on the climb, the nose is above the horizon while the path in space curves violently downwards. Hence the wing assumes a very large angle of incidence

There should above all be no attempt to turn back into the airdrome, as a spinning nose dive is then likely to occur. A great many accidents have followed incorrect action by the pilot under these circumstances.

Problems

1. The plane of 1600 pounds, wing area of 200 square feet, has a maximum lift coefficient of .00320. What is the stalling speed?

Answer: 50 miles per hour.

2. Suppose that this plane is put into flying position, with the wing at 2 degrees incidence, and a Ky of .00140. When the plane has rolled along the ground long enough to attain a speed of 30 miles per hour, what proportion of the load will be carried by the wings, and what proportion by the wheels?

Answer: 250 pounds carried by wings, 1350 by wheels.

3. If the pilot allows the plane to lift itself automatically in flying position, how much higher will the air speed be than the stalling speed?

Answer: The air speed will be 82 miles per hour or 32 miles more than the stalling speed.

4. Would you consider the take-off of Problem 3 satisfactory? If not, how would you modify it?

5. What would you estimate to be the best climbing speed of an airplane whose stalling speed is 60 miles an hour, and maximum speed 150 miles?

Answer: 90 miles an hour.

6. In the examples of this article, the plane is climbing at 90 miles per hour air speed in calm air, and the rate of climb is 861 feet per minute. What is the horizontal velocity relative to the ground?

Answer: 7900 feet per minute.

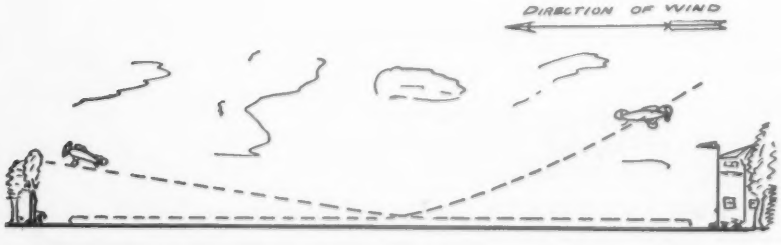
7. If in the preceding problem, the plane takes off at the center of a field which is 1500 feet from the edge of the field, what height of obstacle can the pilot clear?

Answer: 163.5 feet.

8. If in the climb of the preceding problem, there is a horizontal head wind of 20 miles per hour, what height of obstacle will the pilot now be able to clear?

9. If in the climb of Problem 7 there is a tail wind of 20 miles per hour, what height of obstacle will the pilot clear?

FIG. 5—It is easier to clear an obstacle climbing against a horizontal wind



Every Universal instructor is a transport pilot and has had many years of experience in actual student instruction.

Right: Government licensed modern planes equipped with air cooled motors are used at all stages of instruction in Universal Schools.

A class of flight students receiving classroom instruction on theory of flight.

Welding plays a tremendously important part in the construction of modern airplanes. The Universal Welding Course prepares a man to step into a good paying position.

Aviation mechanics are always in demand. Universal students taking Aviation Mechanic's Course receive unusually thorough training.

An Aviation Business Course gives a background of aeronautics to the student who would enter the business side of aviation.

Prepare Now For Next Year's Aviation Opportunities. Before 1930

LEARN TO FLY

YEAR-'ROUND instruction is available in Universal Aviation Schools. Start now to earn your wings. By spring you may become a full fledged transport pilot. All your training will be behind you and you will be ready for the bigger opportunities which will be forthcoming in aviation next spring.

All Types of Training in Universal Schools

Almost any young man can learn to fly under Universal methods of instruction. Modern, easy-to-handle planes are used exclusively. Only transport pilots, with many hours of experience in student instruction, are employed. Complete ground instruction is included in each flying course. Evidence of the safety of Universal training is found in the fact that Universal flight students are insurable through a master insurance policy—the first of its kind covering flight students ever issued by an insurance firm.

Courses in Aviation Mechanics, Aviation Welding and Aviation Business are available either during days or at night. This training is probably the most thorough in the industry. Schools are located conveniently nearby. Send for complete description of Universal Courses, their prices and description of individual schools.

FREE: Mail Coupon

A beautifully illustrated book, "Aviation — What It Means To You," is yours for the asking. It answers all questions and gives you an honest, sincere picture of what aviation is doing and can offer you. Mail the coupon for your free copy.

Universal Aviation Schools

Universal Flying School, St. Louis, Mo.
Universal Flying School, Minneapolis, Minn.
Universal Flying School, Marion, Ill.
Porterfield Flying School, Kansas City, Kansas
Universal Flying School, Oklahoma City, Okla.
Universal Flying School, Rochester, Minn.
Universal Flying School, St. Paul, Minn.
Universal Flying School, Memphis, Tenn.
Universal Flying School, Cleveland, Ohio
Universal Flying School, Wichita, Kansas

Department of Commerce Flying and Ground School rating applied for by all Universal Flying Schools.

CLIP THIS COUPON

UNIVERSAL AVIATION CORPORATION
"THE SKYWAYS OUR HIGHWAYS"

UNIVERSAL AVIATION SCHOOLS
1045-54 Boatmen's Bank Bldg.,
St. Louis, Mo.

Please send me at once your free book, "Aviation —What It Means To You" I am interested in:

☐ Flying Course ☐ Aviation Mechanic's Course
☐ Business Course

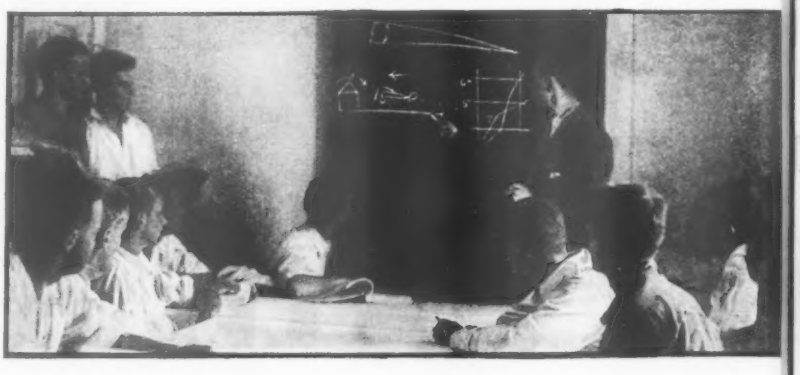
Name.....*Age*.....
Address.....
City.....*State*.....
N 320

CASEY JONES . . . President of Curtiss Flying Service. For many years one of America's foremost pilots.

Here's the

Read it before youp

In this advertisement we tell you what to expect from Curtiss Training



DO you want to learn to fly? Well then, let's talk it over. Perhaps we can give you some helpful pointers from our twenty years of experience here at Curtiss.

In the first place . . . don't go off half cocked. Your first decision is by all odds the most important.

For you've got to pick a good flying school in order to become a good pilot. Any one can learn to fly . . . only a few schools can teach you to fly *well*.

And good pilots . . . the kind aviation needs today . . . have to be *made*. They aren't just born.

We hold that thought in mind always, here at Curtiss. Our whole course is laid out with that one idea . . . to take raw material and turn out *good* pilots.

We began a long time ago. Very carefully picked out the best men we could find to be our instructors. Men of long experience in aviation.

Then we trained them to instruct students. Sent them all to a special instructors' school in Detroit. Taught them how to teach . . . how to make the fine points clear and simple to you.

We set out to parallel Army and Navy training . . . but planned it to make it practical for you in time required and in cost.

What's the result? A method that is entirely Curtiss. A method that would be impossible without the years of experience massed in this organization.

When you go up in Curtiss instruction planes you learn to fly . . . not just to push and pull on the controls.

While you are in training you meet and learn to know the men who are conducting a nation-wide business-of-the-air . . . no just a single flyer or the limited personne of a local flying field.

And when you graduate you are competent flyer . . . acknowledged whereve you go . . . at home on any field . . . no just one of the thousands who can get ship off the ground and back again.

That's why Curtiss-trained pilots are i demand everywhere. Why the 1500 pilot Curtiss has turned out include the leaden in every branch of aviation.

And remember this . . . Curtiss has 4 flying schools in active operation today. All are standard and identical in their training. All are conveniently located, in the aviation centers of their districts.

If you want more complete information about them . . . more details of how Curtiss goes about making good pilots . . . fill out the coupon now.

ROAR-R-R-R . . . the steady drone of motors rarely dies at a Curtiss flying school. Engines warming up . . . ships in and out . . . flying all the time. ABOVE—Picture shows the modern new Curtiss Hangar at Louisville, Ky.

CURTISS

ewhole CURTISS STORY

oupick a flying school

SOLO! No college commencement has a thrill like this! Photo shows Curtiss students watching member of their "class" make his first solo flight. No lack of confidence here . . . early training is too thorough . . . and better equipment isn't made. Above—Note instructor and student testing head phone used at every Curtiss school to aid instruction in the air.

CURTISS FLYING SERVICE
27 West 57th Street, New York City

Gentlemen:

Please send me complete information about the Curtiss flying schools, their locations and an outline of the courses taught.

Name _____

Address _____

City _____ *State* _____

SFLYING SERVICE

"World's Oldest Flying Organization"

Condensed News of the Month

Ford Exhibits in England

European reaction to the type of air transport being used in this country is awaited as a result of the shipment of a Ford 14-passenger and crew monoplane to be exhibited at the International Aircraft Show in London. LeRoy Manning, chief of operations of the Ford Air Lines and senior test pilot of the Stout Metal Airplane Company, will demonstrate the transport in Europe. It is equipped with three Pratt and Whitney "Wasps."

◆

Universal Coast to Coast Service

The opening of the Universal coast-to-coast service, without hullaballoo or hokum, has proved the wisdom of those who planned the route. Frequently the 12-passenger Fokkers have to be run in double-headers between Kansas City, Chicago and Cleveland, indicative of the fact that the public approves of this great circle route across the continent. The service is operated by Universal in conjunction with the New York Central and the Santa Fe railroads. The cost is only $85 more than the all rail fare, and savings are made in the number of meals purchased.

◆

Service Brings Travelers

Western Air Express announced that more than 4,000 persons were carried on Western lines during the first quarter of 1929, as compared with a total of 6,794 for the entire twelve months of 1928. The company keeps two amphibians in service between Los Angeles and Catalina Island and a new service has been started between Los Angeles and Lake Arrowhead, a resort in the San Bernardino mountains about 85 miles from Los Angeles.

◆

Gliders to Enter Cleveland Races

The second National Glider Conference and race program will be held during the Cleveland meet, according to Donald F. Walker of Detroit, manager of the National Glider Association. The organization announces eight different glider events and a program outlining a three-year effort to organize glider clubs throughout the country. Notables who will participate in the conference and race program include Anthony Fokker, builder of the first two-place glider; Dr. Wolfgang Klemperer, Germany's pioneer glider; Amelia Earhart; M. S. Stoughton, who is N. G. A. Pilot No. 1, and Franz Gross, who built the Darmstadt racer which made a world's record of 42 miles in the Rhone valley.

◆

Chemical Cooling

Brigadier General William E. Gillmore, Assistant Chief of Air Corps, U. S. A., has authorized a statement about the recent army tests of chemical cooling, in which it was brought out that by changing the radiators for others of 75% less capacity, between 90 and 100 pounds of dead weight was eliminated and the total resistance in air reduced by 12 percent. Pilots were enthusiastic about the handling of the planes so equipped, and engines functioned better with not the slightest evidence of any trouble or disadvantage.

◆

Lees Becomes Waco Director

Announcement has been made of the election of Robert E. Lees to the board of directors of the Waco Aircraft Company, Troy, Ohio. Mr. Lees continues as sales manager of the company.

◆

Aviation Radio Station

K-T-A-T, owned and operated by the Texas Air Transport Broadcast Company, will be on the air October 1 with an entertaining type of program, according to Silliman Evans, president of the company which is a subsidiary of Southern Air Transport. The power plant will be located at Birdville, near Fort Worth, while the studios will be in the new Aviation building in Fort Worth.

Air Travel Information Service

AERONAUTICS offers its readers a complete fund of information about air travel—schedules, rates and other data of interest to the traveler. With the co-operation of European, as well as American, transport operators, AERONAUTICS will work out for the prospective traveller itineraries showing the routes, schedules and fares over well-known airlines both here and abroad. Many of these tours can be made for the same outlay as any other form of travel.

Buffalo-Toronto Service

Colonial Western Airways has inaugurated a two-trip daily service between Buffalo and Toronto. Flying time between the two cities will be 45 minutes and plane schedules have been arranged for the convenience of travelers arriving by the fast trains from the West and New York. One way fare is $17; round trips, with thirty-day stop-over privileges are $30 and ten-trip commutation tickets are $14 per trip.

◆

Grosvenor Heads Interstate

Aviation Corporation has made public a list of new Interstate Airlines officials which includes the name of Graham B. Grosvenor as president. Mr. Grosvenor is also president of the Aviation Corporation. Interstate, a subsidiary, operates the 623-mile route from Chicago to Atlanta, with stops at Terre Haute, Evansville, Nashville and Chattanooga. Others on the list of officials are Thurman H. Bane and W. G. Schauffler, Jr., vice-presidents; Alexander O. Cushny, treasurer; Alexander H. Beard, secretary and Mr. Bane, Mr. Grosvenor, Frank R. Black, William D. Loucks and Harvey L. Williams, members of the board of directors.

◆

N-A-T Operates Fifty Ships

With the addition of six new Boeing cargo planes the N-A-T fleet now consists of fifty ships, including mail and express planes. The new Type 95 planes are in operation on the New York-Chicago line. They are powered with 525-horsepower Hornets and have a cargo capacity of 1,550 pounds and a cruising speed of 110 miles per hour. Each one is equipped with radio apparatus.

◆

Lockheed-Vega for Whaling Use

Commander Lutzow-Holm of the Royal Norwegian Navy is flying a Lockheed-Vega, Whirlwind engine, which he will use in an Antarctic whaling expedition organized by Bryde & Dahl Whaling Company of Sandefjord, Norway. The ship is equipped with three types

(Continued on page 72)

Without a Moment's Preparation~

Parks Air College Passes Examination of U. S. Department of Commerce as a Transport Pilot School

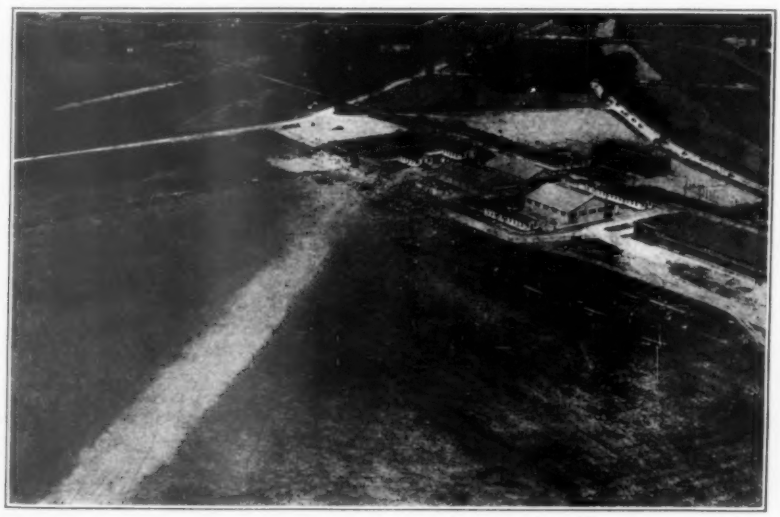
When the United States Department of Commerce representatives recently examined Parks Air College for official approval as a Transport School they found here a great training institution that did not have to *prepare in advance* for the examination.

The high standard and thoroughness of instruction that has been in force right along placed us in the enviable position of being in readiness for the examination without notice.

The completeness of the Pilot and Mechanics Courses — the experience and qualifications of the large Staff of Instructors—the A-I condition of the Training Planes—the completeness of the school's entire equipment—made Parks ready at all times for the most rigid inspection!.... It means that when you decide on a career in the air you should come to Parks Air College and learn *right!*

The Largest Non-Military School in America is the School for YOU!

Here, at our own field, Parks Airport, a great flying center, you will be taught to take-off, to fly, and to land, in ways that make old pilots nod in approval. You will learn cross-country flying. You will be trained in both open and closed-cabin ships. You will learn all about motors, ignition and carburetion. You will actually work on types of motors that are making aviation history. You will learn how to build airplanes. Right in our shop you will construct a ship from nose to rudder and from wings to landing gear. You will rig it, cover it and dope it yourself. You will learn Theory of Flight, Aerodynamics and Meteorology. You will be taught everything connected with flying that is required of a United States Approved School of Flying.



Ideal Conditions for Living and Learning at Parks

At Parks Air College every activity is centered right on the field. Here are administration buildings, an airplane factory, repair shops, spacious hangars, comfortable classrooms, recreation hall, restaurant, and a new, modern, two-story brick dormitory exclusively for students, just completed at a cost of $100,000. Parks Airport is just 15 minutes from the great metropolis of St. Louis, the home of Lindbergh.

Hours of instruction, field work, shop training and flying are on definite schedules. No detail of your teaching is overlooked. When you graduate from Parks you are a qualified pilot. The fact that you are a Parks Trained Pilot will open doors for you that are closed to others. You will go out from our school sure of yourself, sure of your knowledge and your ability to meet every situation in the air or on the ground, instantly and instinctively, in the right way.

Aviation is a fascinating life work with a great future. Its attraction is irresistible. Learn more about it now. Men who have done great things in aviation did not wait to decide. They *acted*. Send for our illustrated catalog, "Skyward Ho!" Clip the coupon and send it now. You may be one of those who will find fame and fortune in the air.

PARKS AIR COLLEGE
AFFILIATED WITH PARKS-AIRLINES-INC.

Largest Civilian Air School in America!

Dept. 206-S, MISSOURI THEATRE BUILDING, ST. LOUIS, MO.

Member Aeronautical Chamber of Commerce of U. S. A.

Parks Air College has been rated by the Aeronautic Branch, Department of Commerce, as an Approved Ground and Flying School.

MAIL THIS TODAY!

PARKS AIR COLLEGE,
Department 206-S,
East St. Louis, Ill.

Send me your illustrated catalog. I am interested in Aviation, particularly as regards the subject checked below:

☐ Flying Course ☐ Airplane and Engine Mechanics Course

Name.....

Address.....

City..... State.....

The Stout Air Lines

By Charles K. Fewkes

AS the engines pick up—roar, the wheels turn lighter—faster, and the big ship takes off, the thrill that comes to the passenger seated in the comfortable chairs of a big air liner, will perhaps never vanish entirely. However, even now, the comfort, convenience, and almost flawless service of the Stout Air Lines, is a source of wonder to the passenger.

Comparatively little is known of the development, experimentation, training of pilots, and system of inspection which have brought the Stout Air Lines to its present position in the air transport world—the interest of a world-wide public, the example for every existing transport company, and the model for future air services.

It is generally known that the high degree of efficiency, safety, and dependability of the Ford all-metal, tri-motored planes, is due to the genius of William B. Stout. Ten years ago, he went about raising money and forming a company to develop his idea, that an airplane could be constructed entirely of metal. Instead of holding up a picture of huge profits to the prospective investor, he put his proposition in a strange way:

"Mr. Business Man, I want to take a thousand dollars of your money and lose it for you on a sporting venture. However, I will guarantee you a thousand dollars worth of fun and aviation experience." Nearly every one who was invited to join the company, caught the spirit of the thing, and later when Henry Ford purchased the Stout Metal Airplane Company, their investment paid two to one.

Up until 1926, no regular passenger routes had been established in the United States, although the mail was being carried by airplane, and certain European lines had carried passengers for the past two years under heavy Government subsidies.

On July 1st, 1926, a "laboratory" route was established between Detroit and Grand Rapids, and for an entire year, the Liberty motored ships flew through fog, sleet, rain, and, in fact, under every possible weather condition. At the end of the year an encyclopedia of information was in the possession of the Stout Air Lines. They knew the amount of gas consumed, the average speed of the planes, the percentage of completed trips, the percentage of trips completed as scheduled, the average number of passengers per trip, the cost of operating the planes per trip, mile, and passenger, as well as other vital statistics.

The Detroit-Cleveland route was inaugurated on November 1st, 1927, with newer and larger ships, and a year later on November 1st, 1928, the service was opened between Chicago and Detroit. As soon as sufficient equipment can be obtained, new lines will be opened to other cities, in a substantial program of expansion.

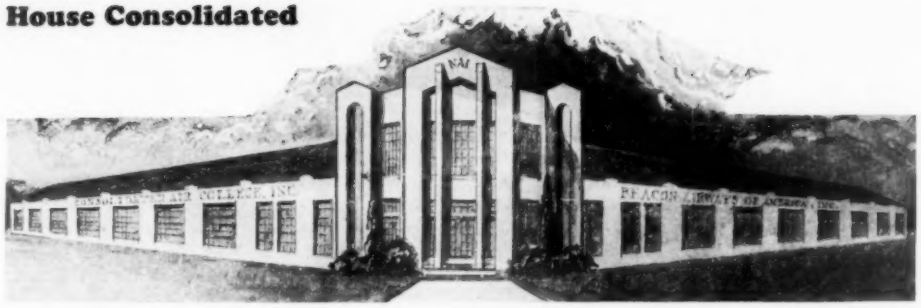
Pilots will be trained to fly the new passenger routes by the method now in operation described by Lucius Lobdell of the Chicago Traffic division.

"It is our belief that the record and reputation of an airline carrying passengers, hinges largely upon the experience and training of the pilots flying their ships. When Henry Ford entered the airplane business a few years ago, he stated that flying was 10% airplane and 90% pilot, and it was the problem of the aeronautical industry to reduce the importance of the human element in the operation of an airplane. Designers today are bending every effort to develop planes that will practically 'fly themselves.'

"A company such as the Stout Air Lines, who are specializing in passenger carrying and are operating large three engine planes, have to look for things in a pilot that are not always of great importance to the mail operator. For this reason the Stout company subjects a

New Building to House Consolidated

Beautiful new building—pictured to the right—will shortly be completed. It will house the various activities of the great National Air Industries, including Consolidated Air College. Think of getting your training in this remarkably modern building situated right on famous Fairfax Airport.



Aviation Demands TRAINED Men

Proper Training Prepares You for Opportunity

Kansas City Welcomes You!

Kansas City, the greatest of air centers, welcomes you. Kansas City will help you in many ways. This thriving center of aircraft manufactures and cross-continent air traffic is astir every day with happenings that vitally affect your career. Here at "Consolidated" you are in the swing of Kansas City's air spirit, close to its big downtown district, within easy distance of the flying fields and to home-like living quarters nearby.

Big Handsome Book Free!

This wonderful 64-page, lavishly illustrated book is yours for the asking. Contains a wealth of information about aviation. Shows pictures of factories, famous planes and fliers, explains step-by-step how you are taught to fly, etc.

CONSOLIDATED AIR COLLEGE,
527 Wyandotte Street,
Kansas City, Missouri.

Please send 64-page illustrated book on aviation, and complete information on subjects marked, in which I am especially interested.

- ☐ *Time Payment Plan*
- ☐ *Ground Course*
- ☐ *Private License Course*
- ☐ *Limited Commercial Course*
- ☐ *Transport Course*
- ☐ *Employment while Training*
- ☐ *Employment After Graduation*

Name .....

Address .....

My age is .....

National Air Industries, a large aviation corporation, is supplying its needed ground men, airport managers, factory men and pilots from its own college. Men trained here at Consolidated Air College (a subdivision of National Air Industries, Inc.) have many wonderful openings right here in our own organization.

In aviation big events move swiftly. No time is available to "break in" untrained men. But great are the rewards to the man with TRAINING! Prepare yourself to command your own figure in your own particular field. Look forward to years of prosperity and success. Get right into the heart of the fastest growing industry in the world today. You can do this—after you have had training here at Consolidated Air College—recognized as one of the finest training schools in the country.

Here with us, you step right into a fast moving, efficient College of the Air which is already a proven, successful organization. From the minute you enroll you are under personal supervision from beginning to graduation. Man-to-man instruction provides one transport instructor and one new-production licensed plane for each group of ten students in the fifty-hour class.

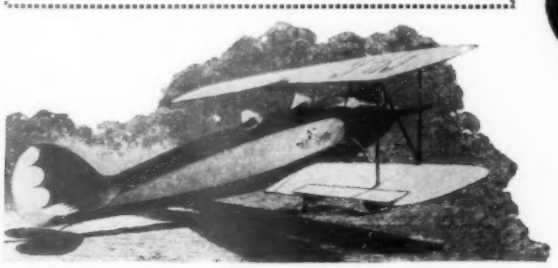
You Fly in Finest Equipment

The best of equipment is waiting for you to use. American Eagle Biplanes equipped with OX5 and Kinner Motors, Monocoupes, Cessnas powered with Wright J5's and Siemens-Halske Motors, and a Wright J5 Ryan. Recently we have added the famous Great Lakes Training ship. This variety of fine training planes gives the student every advantage. Veteran instructors, who have helped make aviation history, teach you every detail thoroughly.

Ground School Course

Many students prefer to take the ground school course before completing the flying courses. Our ground school teaches every detail about motors and equipment, construction, installation, rigging, overhauling and "trouble shooting"; including navigation, meteorology and a new course in parachute operation.

Examination and rating by Dept. of Commerce applied for



CONSOLIDATED AIR COLLEGE Inc.

KANSAS CITY, MISSOURI

prospective pilot to an exhaustive program of training and testing.

"Before a man is considered for one of these positions, he must have a transport pilot's license, and already have a background of several hundred hours of flying on various types of equipment under all possible conditions. In most cases he is selected from the Ford-Stout training school for pilots.

"For a period of approximately three months, the pilot works in the Ford-Stout aircraft factory, doing the actual work in the various stages of constructing the all-metal planes. When his factory training is completed, he is thoroughly acquainted with every detail of the ship, and is as capable of approving an inspection report as an expert chief mechanic.

"From the aircraft plant he goes to the operations department, where he flies with the Ford pilots on the freight planes operating between Chicago, Detroit, and Buffalo. He builds up considerable time in actual transport cross-country operation under the scrutiny and periodic testing of the chief pilot, until he is finally 'soloed,' and considered capable of handling any of the Ford runs.

"Practically all of the pilots who reach this stage have acquired at least a thousand hours of flying time, and it is from this group that the Stout Air Lines select their men for the flying of their passenger equipment. For a period of three weeks he flies with the pilots of the Stout lines, becoming thoroughly familiar with every detail of the course over which he flies.

"The Stout Air Lines are distinctly separate from the Ford Motor Freight Service, and while flying for the former, the pilot comes in contact with the passengers both in the air, and at the terminals. He learns to cooperate with the traffic department in respect to the little courtesies and comforts that add so much to the enjoyment and satisfaction of the passengers. He learns that his loads are made up of all types of people, sometimes a year old baby, a critical business man, or an aged woman, and he must constantly handle the ship for their comfort, by flying smoothly, making gentle banks and gradual ascents and descents.

"After all of the Stout pilots have had an opportunity to check the new man's work, a conference is held consisting of the pilots, operations manager, and general manager, at which time the new man is passed upon. Besides piloting ability, he is also judged as to personality and appearance.

"We are particularly pleased," said Mr. Lobdell, "that our pilots have made innumerable friendships and acquaintances among our passengers. When pilot Sam Taylor was stricken with appendicitis last spring, he received over 200 letters and telegrams from passengers who had flown with him on the Stout lines."

All of the pilots who receive this training do not fly for the Stout Air Lines. Many of them secure positions with other operators. Pilot Kent recently secured a position flying the Ford tri-motors of the Mexican firm, Compania Mexicana de Aviacion.

A Flight Engineer is on board every plane that leaves on a scheduled run. Men of unusual adaptability are required for this position. The Flight Engineer is the official host of the Stout Air Lines and as such, he must have a pleasant personality, be ready to answer innumerable questions, satisfy exacting desires of passengers, care for their comfort, and in general do everything in his power to make the trip as delightful as possible.

The Flight Engineer is also a licensed mechanic and pilot, and relieves the regular pilot at intervals during the trip. He is responsible for the mechanical functioning of the plane and motors from the time it leaves the hangar until it reaches its destination.

The same care that is exercised in choosing the pilots that are to fly the planes, is also exercised in seeing that the ships are in perfect condition before each trip. Three or four hours before a plane is scheduled to leave, the Flight Engineer is notified to get the plane ready. Inasmuch as he is responsible for the plane after it leaves the hangar, he takes a keen interest in the inspection and servicing.

The Daily Inspection and Service Record report of the Stout Air Lines has been developed as a result of much experience and care. On a single sheet is shown the report of the pilot, the airplane inspection of fuselage, wings, empenage, controls, and undercarriage; the inspection of motors and accessories by the mechanic, the servicing done by the mechanic, and final okeh by the foreman. A regular routine is followed and every part which may possibly develop trouble is carefully classed and inspected. For example, under the airplane inspection of controls, the following parts are tested: wheels, rudderbars, cables, pulleys, and hinges. The Flight Engineer is as familiar with every part of his ship, as the careful groom is familiar with every part of a thoroughbred race horse. In a sense, he has "lived with her, and slept with her."

It is not enough that the planes be rigidly inspected at the hangar, but in order to complete the highest percentage of scheduled flights, up-to-the-minute weather reports are furnished each pilot. Reports received from fifteen to thirty minutes before departure are considered up-to-the-minute. Weather conditions change so rapidly that anything older than an hour is not considered particularly useful. On a recent flight from Detroit when the weather was very doubtful in Chicago, the final report was received over the phone at the Dearborn field, and was handed to the pilot four minutes before the plane was scheduled to leave!

Some idea of the detailed information furnished the pilot may be gained from the following example

LEARN AVIATION AT THE AIR CAPITAL!

You Can Train at This Outstanding School In the Very Heart of Aviation Activity

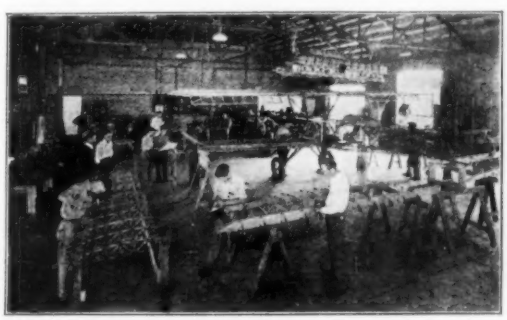
REGARDLESS of your previous education, if you are over 15 there is a place for you in aviation—and the gate to your opportunity is The Braley School of Flying (Wichita's Air University).

The demand is increasing for properly trained men—factory men and specialists in ground jobs are absolutely needed as pilots—and graduates of The Braley School of Flying gain quick recognition because of the standing of this great institution among aviation leaders. The majority of Braley School graduates are readily placed in jobs right in Wichita.

ON its own 320 acre airport, surrounded by factories and almost adjoining the municipal airport, in a set of modern brick buildings housing one of the most complete ground schools in America today, The Braley School of Flying is the logical school for everyone who seeks success with a minimum cost commensurate with adequate training.

Here you can live comfortably in a modern hotel-dormitory, at exceptionally low rates, enjoying constant contact with aviation and fellowship of other well trained, well satisfied students.

PILOTS WANTED!
Clarence Chamberlin predicts a pilot famine because the number of planes being produced far exceeds the number of pilots training. Start Training now.



View of Factory Department, Braley School of Flying

EMPLOYERS!
Keep in touch with The Braley School of Flying for thoroughly trained men for flying service or factory work. Conscientious Recommendations.

The BRALEY SCHOOL of FLYING Inc.

Aviation experts who visit The Braley School of Flying declare it to be an exceptional school. Be guided by men who have seen. Examination and rating by Dept. of Commerce applied for.

WICHITA KANSAS

THE BRALEY SCHOOL OF FLYING
212 Braley Airport, Wichita, Kans.
Gentlemen: Please send me "The Dope" about aviation in the Air Capital.

Name..... Age.....
Rt..... City.....
St..... State.....

of information furnished on the Detroit to Chicago run. Reports are received from Chicago, Lakeville, Kalamazoo, and the home port, Dearborn. Each station reports on the weather, visibility, ceiling, sky, temperature, clouds, and barometer. The direction and velocity of the wind at various heights from 820 to 16,400 feet is also reported.

The weather is reported as fair, cloudy, stormy, raining, et cetera. Visibility on the ground is judged in terms of miles. The ceiling is reported in terms of feet. The condition of the sky is reported as clear, overcast, or partly overcast. Temperature and barometer readings are noted in the usual manner. Clouds are classed as cirrus, stratus, cumulus, nimbus, or their intermediate varieties. The direction and velocity of the wind determines the altitude at which the pilot will fly, other conditions considered.

The ceiling, or height of overhanging clouds above the ground, is always of particular interest to the pilot. Few pilots care to fly in weather which will not enable them to see the ground. They dislike having to climb above the clouds until they no longer see familiar landmarks passing below.

The percentage of flights not completed on account of bad weather will soon be considerably lessened when directional radio and radio telephony are developed to where they warrant general usage. The value of radio to passenger flying, can be easily illustrated.

The 4:45 P. M. plane from Cleveland recently took off with favorable weather conditions reported over the entire route to Detroit. However, the pilot was told that the weather might change suddenly. When he reached the vicinity of Toledo, the pilot ran into a wall of fog which he found he could not go over or around. He had no way of knowing how far the fog spread northward, or what conditions existed at Detroit. After seeking in vain for an opening, he did the sensible thing to do—turned back to Cleveland. It so happened that the fog was only a few miles in width, and in Detroit the sun was shining brightly.

Had the pilot been able to communicate with Detroit, he would perhaps have been instructed to proceed through the fog, inasmuch as a fair landing was assured him at Detroit.

After each flight, the pilot fills out the Daily Flight Report describing the actual weather encountered, and listing information for the benefit of the operating and traffic departments.

The nature of the flight is indicated as either scheduled, special, tour, or ferry. Hour of departure and arrival at destination is shown, together with the elapsed time and number of miles flown. For the information of the traffic department, the number of men and women passengers are shown. In extremely rare instances a passenger is reported seasick, which, contrary to what may be supposed, is not entirely due to bumpy air, but rather to some isolated cause, or to the passenger's failure to open the sliding windows to properly ventilate the cabin. In a place for remarks, the pilot may have something to say regarding the performance of the ship, noted passengers, unusual weather such as snow, sleet, or winds, or any other item of interest.

Air-rail hook-ups are playing an important part in the development of passenger air lines, and in this field the Stout Air Lines and the Michigan Central Railroad have recently arranged the cheapest rate between New York and Chicago. The total fare is only $63.60. This figure includes extra fare and lower berth on the train. Planes leave Chicago via the Stout Air Lines at 3 P. M. Central Time, and arrive Detroit at 6:30 P. M. Eastern Time. Connection is made with "The Detroiter," a fast, extra fare train leaving over the Michigan Central at 7:10 P. M. Passengers arrive in New York at 9:30 A. M., ten minutes ahead of the Century.

The minute care, and safety methods employed by the Stout Air Lines have resulted in a remarkable record. During the twelve months of 1928, the Stout Air Lines ships flew without the slightest mishap, a total of 213,000 miles, more than double the miles flown during 1927. Officials of the system anticipate that the total number of miles flown during 1929 will triple the number flown during 1928. It is astonishing when we stop to think that already over 66,000 persons have flown in the Stout ships.

ONE OF THE REPORTS

Information valuable to the operating and traffic department is recorded by the pilot and a check on the accuracy of the weather forecast is also available.

Stout Air Lines

DAILY FLIGHT REPORT

Plane No._____ CHICAGO TO DETROIT

Engine No. { L.____ C.____ R.____ Date_____
Lib.____

Nature of Flight: Scheduled Special Tour Ferry

Left_____ At_____

Arrived_____ At_____

Elapsed Time_____ Hours_____ Minutes_____ Miles

No. of Passengers_____ Men_____ Women_____

No. Seasick_____ Men_____ Women_____

Gas put in_____ Gal. Gas carried_____ Gallons

Oil put in_____ Gal. Oil carried_____ Gallons

1. Prevailing Altitude Flown_____ Feet_____
2. Visibility_____ Ground_____
3. Weather_____ Ground Temperature_____
4. Condition of air_____
5. Indicated Air Speed_____ M. P. H._____
6. Alternate Pilot_____ Time Piloting_____ Landings_____
7. Remarks_____

Signed_____
Pilot

Form A-6

Stout Air Services, Inc.

Detroit Cleveland Chicago

DAILY INSPECTION AND SERVICE RECORD

Date.....

Plane No..... Motor No. Lib..... L..... C..... R..... Terminal .....

PILOT'S REPORT

	Lib	L.	C.	R.
Oil Pressure				
Ground Full Throttle R.P.M.				
Full Throttle R. P. M.				
Cruising R. P. M.				
Temperature				

Airline Time.....
Tour Time.....
Amperes.....
Air Speed.....

REMARKS:

Signed.....
PILOT

AIRPLANE INSPECTION

FUSELAGE:	WINGS:	EMPENAGE:	CONTROLS:	UNDERCARRIAGE:
Propeller	Hgrbolts	Stblzr.	Wheel	Shock Absr.
Motor Mount	Ailerons	Fin	Rdrbar	Struts
Cockpit	General	Elevators	Cable	Fittings
Cabin and Aft		Rudder	Pulleys	Wheels-Axle
Tailskid	PYRENE:		Hinges	Brakes

REMARKS:

Signed.....
INSPECTOR

MOTOR AND ACCESSORIES

LIBERTY:	WRIGHTS:	L.	C.	R.
Water plug	Oil connections			
Oil plug	Valve springs			
Valve springs	Valve clearance			
Connections	Tappets (greased)			
Throttles	Rockers "			
	Throttles			

FUEL SYSTEM:	LIB.	L.	C.	R.
Colodore				
Carb. strns.				
Fuel lines				
Tanks				

IGNITION:	IGNITION:	INSTRUMENTS:
Heads	Brkr. points	Oil pressure
Brkr points	Distributor	Fuel pressure
Generator	Wiring	R. P. M.
Battery	Spark plugs	Ammeter
Switch		
Wiring		

REMARKS:

Signed.....
MECHANIC

SERVICE

Gasoline put in..... Total gasoline in.....
Oil put in..... Total oil in.....

Oil drained.....
Plane washed.....
Motor washed: Lib.... L.... C.... R....
Cabin cleaned.....

Materials, parts or instruments used on plane this date:
NEW: USED:

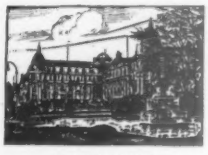
Signed.....
MECHANIC

THIS PLANE IS READY TO BE FLOWN.

Signed.....
FOREMAN

Hotel Ritz
15 Place Vendôme
Paris
4/6/29

HÔTEL LOTTI
7-9, Rue de Castiglione
PARIS



Nassauer Hof
WIESBADEN, den June. 3. 29.

Aeronautics
608, South Dearborn Street,
Chicago.

Hôtel Astoria
Bruxelles 3rd June, 1929.

HÔTEL DE CRILLON
PLACE DE LA CONCORDE
Paris, le June 3rd. 19 2.

THE FREDERICK HOTELS LIMITED

MANAGER'S OFFICE,
Hotel Great Central,
London.

Are You going to visit the
HOTEL BREANGER, BANDOENG, JAVA, in the Dutch East Indies?
Or will it be the
HOTEL GLORIA, in Rio de Janeiro?

In either case just drop in the reading room and ask for the latest copy of AERONAUTICS.

AERONAUTICS can be found in the reading rooms of leading hotels throughout the civilized (and in some cases, the uncivilized) world. Over 300 foreign reading rooms carry AERONAUTICS on file each month.

Thirty-one foreign countries are covered. In London, alone, fifteen reading rooms are thus supplied; in Paris, sixteen.

Perhaps you yourself do not intend to stop at or visit any of these 300 hotels. But maybe your advertising message will interest others who do visit these out-of-the-way commercial centers.

Use AERONAUTICS and send your message to the ends of the world.

Hotel Hermitage
LE TOLQUET
FRANCE

3rd.June 1929

W.B.ZIFF Esq.
Publisher
"Aeronautics"
608 South Dearborn Street
CHICAGO

MHW/GEN

MITRE HOTEL,
OXFORD.

June 1st. 1929.

HOTEL ENGLISCHER HOF
FRANKFURT a MAIN

DIRECTION Kr/Sc.01053/20. June 4th. 1929.

ARTHUR TOWLE,
Controller, L.M.S.
Hotel Services,
St. Pancras, N.W. 1.

"One of the L.M.S. Hotels."
Adelphi Hotel,
LIVERPOOL.

Telegraphic Address:
"HOTEL"
Liverpool.
Telephone:
Royal 6620

GRAND HOTEL
KARLSBAD

KARLSBAD, den June 4th 1929.

HOTEL ERNST AUGUST
HANNOVER
PALAST-HOTEL
HANNOVER
WEINGROSSHANDLUNG
FRIEDR. WILH. NOLTE
HANNOVER
HOTEL
„DER KAISERHOF"
BAD PYRMONT

Hannover, den 3. Juni 1929.

A.-G. GRAND HOTEL NATIONAL
LUCERNE

Lucerne, June 3rd 1929.

Telegramm-Adresse:
„Atlantic" Hamburg
Fernsprecher: Hansa 3600-3632

Bank-Konten:
Norddeutsche Bank, Abt. d. Deutsch. Commerz- u. Privat Bank.

Hotel Atlantic
Restaurant Perdile
Hamburg, 5th June, 1929.

The Aeronautics,
Attention of Mr. W. B. Ziff,

OSTENDE-PLAGE DES BAINS

HOTEL SPLENDID
HOTEL DE LA PLAGE
HOTEL CONTINENTAL
Soigné, June 5th.1929.

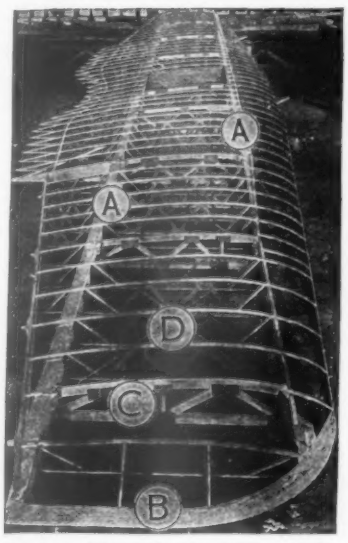
AUG. DECLERCK & Cie
Propriétaires
en nos Hotels

Messrs. Aeronautics
608, South Dearborn Street
Chicago.

HOTEL DE L'EUROPE
& Villa Victoria
AIX-LES-BAINS
2nd June 1929

XUM

SITKA SPRUCE



Airplane Wing Construction of Sitka Spruce. A—Wing Spar; B—Wing Bow; C—Compression Strut; D—Web Rib.

Sitka Spruce, scientifically cured and of Aircraft quality. Our technical knowledge of aircraft requirements and practical experience in airplane construction enables us to fill your needs intelligently.

PLYWOOD

All thicknesses—1/32", 1/25", 1/24", 3/64", 1/16", 1/8", 3/16", 1/4", 3/8".

We also carry
BALSA WOOD
MAHOGANY
HICKORY
ASH
POPLAR
MAPLE
BASSWOOD
CEDAR
Etc.

SPEED IN DELIVERY

We carry complete stocks and can give you assurance that your order will be shipped same day received.

WRITE FOR CATALOG AND PRICE LIST

Your request by letter or postal will bring a copy of this new, complete Catalog of SITKA SPRUCE and other Aircraft Woods.

YOHO & HOOKER LUMBER COMPANY

Largest Assortment of Aircraft Woods in the World

522 Williamson Ave. **YOUNGSTOWN, O.**

Learn to Fly with Air Mail Operators « « «

Gain the advantage of learning to fly under the direction of Air Mail operators. Each of our four schools is located at a commercial airport and on one of our Air Mail lines. Instruction at these schools is based upon our experience in the operation of air mail routes, and includes just what a student should know to qualify for private flying and general commercial work. Many of our instructors are former air mail and army-trained pilots, recognized as the best of flyers.

Courses of 10, 20, and 50 hours are offered, each with a complete ground course, including mechanical instruction. They may be taken the year round at all of the schools, and may be arranged to suit the convenience of the student.

More detailed information regarding the schools and courses offered will be mailed at your request. Simply send the coupon.

Flying schools at:

Richmond, Va. . . . Municipal Airport
Greensboro, N. C. . . Municipal Airport
Spartanburg, S. C. . . Municipal Airport
Atlanta, Ga. . . . . Candler Field

PITCAIRN AVIATION, Inc.,
Sperry Bldg., Manhattan Bridge Plaza, Brooklyn, N.Y.

The Curtis Robin cabin monoplane for pilot and two passengers.

Sales agents for Curtis Airplanes including:

Curtis Robin
Sikorsky
Ireland Amphibion & Flying Boats
Cessna Aircraft

PITCAIRN AVIATION, Inc.,
Sperry Bldg., Brooklyn, N.Y.

Please send me complete information regarding your flying schools and flying courses.

Name.....

Address.....

Naval Flight Test Procedure

(Continued from page 34)

well as keeping track of his location in order not to get lost. From the pilot's point of view, this is quite important. Modern single-place fighting planes have ceilings in the neighborhood of 30,000 feet and initial climbing rates on the order of 3,000 feet a minute. It is a pleasure to climb them—the only drawback being the inconvenience and discomfort attendant on the paraphernalia necessary to provide the pilot with the necessary comfort—oxygen, heavy clothing, face mask, heavy gloves, moccasins, and the like.

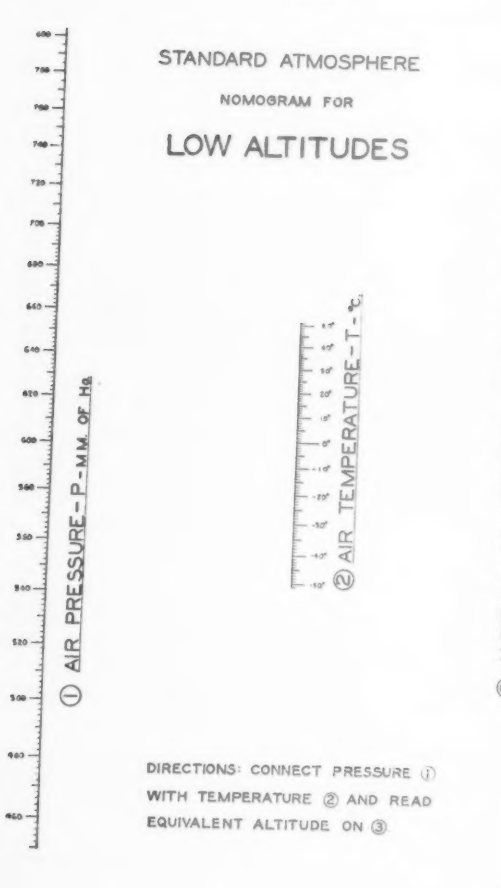
Supercharged engines are becoming common in high altitude ships. These further complicate climbing procedure. To protect the engine, it is necessary to limit the use of the supercharger below certain altitudes in order that excessive cylinder pressures with the resulting danger of detonation will not be obtained —this naturally cuts down the performance attainable near sea level. If the supercharging is not excessive, for the purpose of obtaining performance the engine may be operated at full throttle near the ground and protected against damage by the use of special fuels. In a recent test of a high performance airplane, a fifty percent benzol mixture, as well as ethyl fluid, was used and a number of partial climbs to ten thousand feet using full throttle were made. Due to its high freezing point, benzol cannot be used in the extreme cold of the higher altitudes. The climbs were completed by using aviation gasoline doped with ethyl fluid. Thus, the climbs were made in two parts—up to 10,000 feet using benzol and then from 10,000 feet to the ceiling using ethyl fluid. Such a procedure is, of course, impossible for service operation but it gave a means of obtaining performance data.

When the pilot reaches the service ceiling, he terminates his climb by diving sharply in order to make a jog in the barograph record. He then proceeds to the obtaining of speeds at altitudes. One of these is obtained at as near the service ceiling as is possible. The procedure in this case consists in leveling out at a set altitude and noting from the airspeed indicator the maximum speed obtainable at this altitude. Fig. 3 shows a typical barograph record. (Note the flat portions as speeds at altitudes are obtained.) At the same time, readings of r.p.m. and air temperature are recorded. To aid in maintaining level flight at the chosen altitude, several instruments are available. One is the statoscope shown in Fig. 4, a very sensitive manometer capable of indicating the minute variation of atmospheric pressure between altitude differences of only a few feet. Another instrument is the rate of climb indicator. If neither of these is available, fairly satisfactory results may be had from the altimeter. Level flight is maintained for four or five minutes at the altitude in order to allow the plane to settle down to maximum speed, the engine to work up to maximum r.p.m. and the instruments to settle down to steady reliable readings. This done and the data recorded, the pilot descends to the next altitude and repeats the procedure. Very careful manipulation of the mixture control is necessary throughout this period and considerable practice, ability, and experience are required for good results.

Climbing must be done during good weather. It is worse than useless to attempt to obtain climb data on a slow climbing ship in rough or gusty air. Speeds at altitudes are even harder to obtain under these conditions. The same applies in a less degree to the fast climbing high altitude planes, as it is most uncommon to encounter gusts at the higher altitudes and at the lower altitudes the fast climbing ship rides through the bumps with less effort. For reliable results, however, good weather is essential in every case.

The climbs concluded, the trial board proceeds to the testing for stability. Each condition of service loading is investigated at three speeds, that is, at high speed, at cruising speed, and at a speed near crawling. Navy practice requires that the ship show positive stability with fixed controls. To determine this, the stabilizer is adjusted for level flight at set r.p.m.'s. The stick is then displaced in the longitudinal plane, changing the attitude of the ship, and then the stick is returned to the original position and held there. If positive stability is present, the plane will return to its original attitude of level flight. The length of time necessary and the number of oscillations passed through in returning to this attitude determines the degree of positive stability. This refers to longitudinal stability. Directional stability is checked by noting the ease or difficulty with which skids may be corrected by applying opposite rudder. Lateral stability is tested by noting whether or not the application of rudder causes the plane to bank and which way and whether or not in a side slip the low wing tends to rise or to go lower. In a stable ship once the control surfaces and the engine are adjusted for level flight, it will tend to return to this condition no matter about which axis or in which manner it is displaced. Large planes are required to show considerable

FIGURE 5


STANDARD ATMOSPHERE
NOMOGRAM FOR
LOW ALTITUDES
① AIR PRESSURE - P - MM. OF Hg
② AIR TEMPERATURE - T - °C.
③ ALTITUDE IN STANDARD ATMOSPHERE - Z - FT.
DIRECTIONS: CONNECT PRESSURE ① WITH TEMPERATURE ② AND READ EQUIVALENT ALTITUDE ON ③

In the October Issue of

AERONAUTICS

¶ **Is Congress Air-Minded?** *by Rep. F. H. La Guardia*
The well known Congressman from New York has much to say about Congress and its attitude toward aviation in a virile article on this vital question

¶ **This Man Fleet** *by Helen Kay Schunck*
An intimate sketch of the head of Consolidated Aircraft Company

¶ **Army Flying Training** *by Major General James E. Fechet*
The Chief of the Air Corps gives the aims and purposes of army training

¶ **A Mechanical Flight Tutor** *by S. R. Winters*
The latest in student equipment to enable instructors to shorten the time needed to instruct on control operation

¶ **Flying for Sport** *by Kent Sagendorph*
A pilot takes a few days off to fly a light plane about the country "just for fun," in the modern equivalent of a leisurely tour

¶ **Those Flying Marines** *by F. W. Wead, U. S. N. (ret.)*
A fascinating summary of the flying history of the Marine Corps

¶ **A Pilot's Wife Speaking** *by Nelle F. Dooley*
Another response prompted by one of Margery Brown's articles, in which the wife has words to say about her own flying

¶ **"Many Inventions"** *by Cdr. Douglas G. Jeffrey, R. N.*
The fifth in the series covering air navigation by an English naval officer and pilot

¶ **Is That the Law?** *by Bailey Samelow*
An American attorney discusses legal questions in aviation in the light of the most recent developments, in what will be a regular department in AERONAUTICS

¶ **Economies of Combining Airplane and Automobile Sales** *by Andrew R. Boone*
The possibilities of both immediate and future profits are discussed in the light of actual dealer experiences

¶ **Why Long Distant Flights?** *by Allen H. Loughead*
The President of the Lockheed Aircraft Co. points out the real value of what some critics call "stunts"

¶ **Air Speed and Wind Problems** *by Lt. Cdr. P. V. H. Weems, U. S. N.*
The inventor of the Star Altitude Curve system of avigation discusses some very practical problems confronting the pilot

¶ **Aerodynamics** *by Alexander Klemin*
The head of the Guggenheim Foundation College of Engineering, New York University, continues his practical course

Other timely articles and features.

Largest Selling Aeronautical Publication in the World

25 CENTS A COPY . . . . . $2.50 A YEAR

stability about all axes. In light highly manoeuverable ships slight positive or neutral stability is aimed at. During this period, the airplane is likewise tested in its appropriate manoeuvers and acrobatics. Any peculiarities are noted and recorded for use in the flight test report.

Reduction of Data

It now becomes necessary to reduce the recorded data to standard condition. This is required in order that data obtained under different conditions may be comparative. Mention was made before of the method used to obtain the airspeed indicator calibration. The reduction of climb data is somewhat more complicated and will be discussed briefly. The method used is described in great detail in N. A. C. A. Report No. 297.

For the sake of simplicity, it may be stated that all observed performance data are corrected to a "standard atmosphere." The "standard atmosphere" is an arbitrary variation of pressure, temperature, and density with altitude, but the variation is made to agree closely with the average of Weather Bureau observations. However, no set of conditions ever fits exactly to the standard and it is necessary to correct for the deviations. The correction to standard atmosphere may be made by the use of the "pressure altitude," the "density altitude" or by a combination of the two. As named, the pressure altitude depends upon atmospheric pressures. The barograph records pressures and knowing the barograph calibration the reading of the barograph at any point of the climb may be translated into pressures in terms of millimeters of mercury. Standard tables are available for converting these pressures to altitudes in feet or meters. The density altitude depends upon both the atmospheric pressure and the temperature. To translate the recorded pressures and temperatures into feet of density altitude recourse is had to a nomogram, shown in Fig. 5, provided for the purpose. A line drawn connecting the appropriate pressure with the appropriate temperature intersects the altitude scale at the corresponding point. The density altitude so obtained might lie above or below the pressure altitude obtained directly from the barograph reading. In the past investigators have been somewhat at a loss as to which altitude should be used and when. At certain periods of the year, it was considered that the pressure altitude presented the truer picture and at others the density altitude was chosen. Recently, after a great deal of investigation and labor covering all the climbing data which had been collected over a period of several years and in all seasons of the year, Diehl evolved what he considered a standard altitude for the reduction of climb data. This was between the two and lies about .36 of the distance from the pressure altitude to the density altitude. Using this standard has given excellent results and has provided a basis of directly comparing climbing characteristics no matter what the time of the year or the locality. To obtain our climb curve, then, we first find our pressure altitude at any instant, then our density altitude at the same instant, using the nomogram. Next, we take .36 of the difference between the two and apply it to the pressure altitude in the direction of the density altitude. This gives us points of standard altitudes at recorded times. Using these data the climb curve is constructed with altitude as ordinates and times as abscissa. Fig. 6 shows curves of climbs and rates for the three altitudes. This curve is constructed for each climb. The slope of this curve at any point gives the rate of climb at that point. The rate of climb curve is thus plotted for each climb. This done, a mean rate of climb curve is drawn—representing the mean of all the climbs. With this established the corresponding time of climb curve is calculated and is taken as the climb of the airplane. To trace the sequence again; we first plot the time of climb curve for each climb—from these curves we obtain the rate of climb curves. Taking a mean of these, we obtain what we consider to be the rate of climb curve of the airplane. From this rate of climb curve we calculate the true time of climb curve.

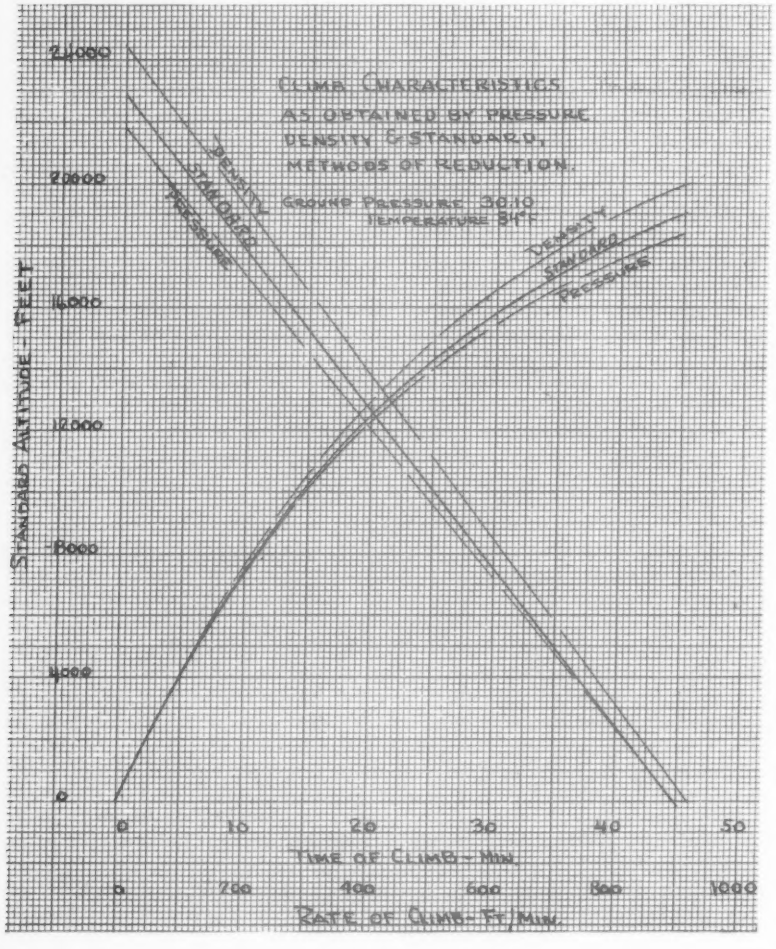


FIGURE 6
Curves of climbs and rates for three altitudes

Until recently it had been customary to plot the rate of climb curve as a straight line although it was known that it should be a curve somewhat concave upward. The results of a great many climbs established beyond doubt that the curve and not the straight line must be used to correctly represent the results obtained from flight test. Diehl was able to develop a method and formulae which satisfactorily permits of this. His method was fully described in "Engineering Aerodynamics."

Next, the speeds at altitude must be

(Continued on page 83)

FLIGHT TEST DATA

Airplane ..... *No.* ..... *Pilot* ..... *Date* .....

Ground temperature ..... *Ground pressure* ..... *Weight of airplane* .....

Wind velocity and direction ..... *Propeller design* ..... *Diameter* .....

Pitch ..... *No. of blades* ..... *Time of Flight* ..... *A. M. P. M.*

CLIMB TO CEILING AND SPEEDS AT ALTITUDES

Time	Air Temp.	Altimeter	Air Speed Indicator	R. P. M.	Oil Press.	Fuel Press.	Oil Temp.	Water Temp.	Altitude	Air Speed
0										
2										
4										
6										
8										
10										
12										
14										
16										
18										
20										
25										
30										
35										
40										
45										
50										
55										
60										

Altimeter	Air Speed	R. P. M.	Air Temp.	Altimeter	Air Speed	R. P. M.	Air Temp.

SGO-25

FLIGHT DATA

Airplane Type ..... No. ..... Date .....

Place ..... Pilot .....

Ground Temperature ..... Ground Pressure .....

Test .....

Remarks .....

FLIGHT TEST DATA

Airplane ..... *No.* ..... *Pilot* ..... *Date* .....

Ground temperature ..... *Ground pressure* ..... *Weight of airplane* .....

Wind velocity and direction ..... *Propeller design* ..... *Diameter* .....

Pitch ..... *No. of blades* ..... *Time of Flight* ..... *A. M. P. M.*

AIR SPEED INDICATOR CALIBRATION

Length of course in feet .....

Direction of wind with respect to course in degrees .....

Run	Time Over Course	Air Temp.	Air Speed Indicator	R.P.M.	Altitude	Ground Speed
1						
2						
3						
4						
5						
6						

FLIGHT TEST DATA

Airplane ..... *No.* ..... *Pilot* ..... *Date* .....

Stability and Balance with Fixed Controls

1. LONGITUDINAL STABILITY

Start with condition of horizontal flight	Low speed	Cruising speed	High speed
1. Indicated altitude			
2. Indicated air speed			
3. R. P. M.			
4. After giving down elevator and returning it to original position, does the airplane return to its original air speed and R. P. M.?			
4a. Is oscillation (hunting) absent, slight, or pronounced?			
5. After giving up elevator and returning it to original position, does the airplane return to its original air speed and R. P. M.?			
5a. Is oscillation (hunting) absent, slight, or pronounced?			

6. Is the airplane steady in a dive at a speed of 100 m. p. h. in excess of maximum horizontal speed? (For fighting planes only.) .....

2. LATERAL STABILITY

1. With ailerons in neutral, does application of right rudder cause the airplane to bank? ..... Which way? .....
2. With ailerons in neutral, does application of left rudder cause the airplane to bank? ..... Which way? .....
3. In a right sideslip, at a constant angle of yaw, does the lower wing tend to drop, rise, or remain at the same angle of bank? .....
4. In a left sideslip, at a constant angle of yaw, does the lower wing tend to drop, rise, or remain at the same angle of bank? .....

3. DIRECTIONAL STABILITY

1. Does the airplane immediately respond to gentle use of the rudder alone at high speed? ..... At low speed? .....
2. Can a skid to the right be immediately stopped by the use of the rudder alone at high speed? ..... At low speed? .....
3. Can a skid to the left be immediately stopped by the use of the rudder alone at high speed? ..... At low speed? .....
4. Does the airplane require excessive use of the controls during turns or in bumpy air? .....

WEIGHT DETERMINATION

AIRPLANE ..... NO. ..... DATE .....

OBSERVER .....

LOAD CONDITION .....

HORIZONTAL DISTANCE FROM REFERENCE POINT TO:

(a) RIGHT FRONT SUPPORT .....

(b) LEFT FRONT SUPPORT .....

(c) RIGHT REAR SUPPORT .....

(d) LEFT REAR SUPPORT .....

ANGLE OF THRUST LINE TO HORIZONTAL .....

DISTANCE OF THRUST LINE AT PROPELLER HUB ABOVE (BELOW) REFERENCE POINT .....

	WEIGHT ON SUPPORTS			
	RIGHT FRONT	LEFT FRONT	RIGHT REAR	LEFT REAR
GROSS WEIGHT				
TARE				
NET WEIGHT				

NOTE: DISTANCES MEASURED BELOW AND FORWARD FROM REFERENCE POINT SHALL BE CONSIDERED NEGATIVE.

Figures 7-11, inclusive.

Save Weeks of Groundwork with these two Great New Books

Here is the most complete information on every type of Aircraft motors ever published. Written by a leading instructor and authority for flying schools, pilots, field mechanics, shopmen, engineers, students and beginners. A gold mine of necessary information for everyone everywhere in the aviation profession.

JUST OFF THE PRESS

2000 (6x9) Pages—1000 Illustrations and Diagrams including 50 Tables

Modern Aviation Engines

Their Design, Construction, Installation and Repair

By MAJOR VICTOR W. PAGÉ, Air Corps, U. S. A., Author of "Modern Aircraft," "A B C of Aviation," "Everybody's Aviation Guide," etc.

More than 2000 large (6x9) pages, fully illustrated with 1000 engravings and diagrams, including 50 special charts and tables.

Now you can have from one of America's leading aviation authorities the two most comprehensive and the two most important aviation and home study books ever printed.

After five years' preparation these two volumes bring you practical, up-to-the-minute and authoritative information on the original design, the construction, the operation, the repair and use of all types of aircraft engines.

Explains Every Type of Aircraft Motor

These two costly illustrated volumes contain forty-six chapters describing the leading aircraft engines of all nations. Special chapters give detailed descriptions of leading commercial engines such as the Wright Whirlwind and Cyclone, the Pratt and Whitney Wasp and Hornet, Anzani, Cirrus Mark II and III, Packard, Curtiss, and Caminez air and water-cooled types.

The servicing, overhauling and repairing of these engines and others are given in minute, careful detail. *These two great new volumes will bring anyone a better and more thorough understanding of all types of aviation motors.* They will show you why certain designs and types are favored, why airplane engines work as they do, how they are designed, constructed, installed, serviced, repaired and operated in flight. All accessory systems such as lubrication, carburetion, cooling and ignition are described at length.

Prepared with Army and Navy Cooperation and Leading Aviation Engineers

MODERN AVIATION ENGINES, by Major Victor W. Pagé, was prepared with the cooperation of the Army and Navy authorities and leading commercial airplane and engine constructors. This 2-volume set will bring new and valuable information to the most advanced professional; it is being rapidly adapted for study by all leading aviation schools and beginners are using it to save many hours of ground work later on.

Supply Limited—Order at Once

The coupon gives you an opportunity to examine this set for five days. If dissatisfied in any way return the books and we will cheerfully refund your money. If you are not in a position to take both volumes at the same time, you may order only one volume and purchase the other later on.

SEND NO MONEY— Just Clip and Mail the Coupon

We have bound a limited number of sets of these valuable books to sell at $9.00 per set of two volumes—or $5.00 per volume if ordered singly. YOU MUST ACT QUICKLY. Clip and mail the convenient coupon today. NOW! Norman P. Henley Publishing Co., 2 West 45th Street, New York, N.Y.

Norman P. Henley Pub. Co., P. A. 9-9
2 West 45th St., New York, N. Y.

Gentlemen: Please send books checked below with the understanding that I have the privilege of examining the shipment for five days. I will give the postman the purchase price and postage as a deposit. If not satisfied, I will return the books, and you will refund my money.

Check choice

☐ Volumes I and II of **MODERN AVIATION ENGINES**, by Major Victor W. Pagé, 2000 pages, 1000 illustrations, at your special reduced price of $9.00 for the set.

☐ Volume I only, at the introductory price of $5.00.

☐ Volume II only, at the introductory price of $5.00.

Send to .....

Address .....

NOTE—If you enclose remittance with this coupon, we will pay postage charges and allow you the same generous five day return privilege. (No C. O. D. shipments to Foreign countries or Canada.) P. A. 829

The Story of Vertical Flight

By Ernest W. Fair

(Continued from page 16)

plane is also controlled in the conventional manner of the airplane.

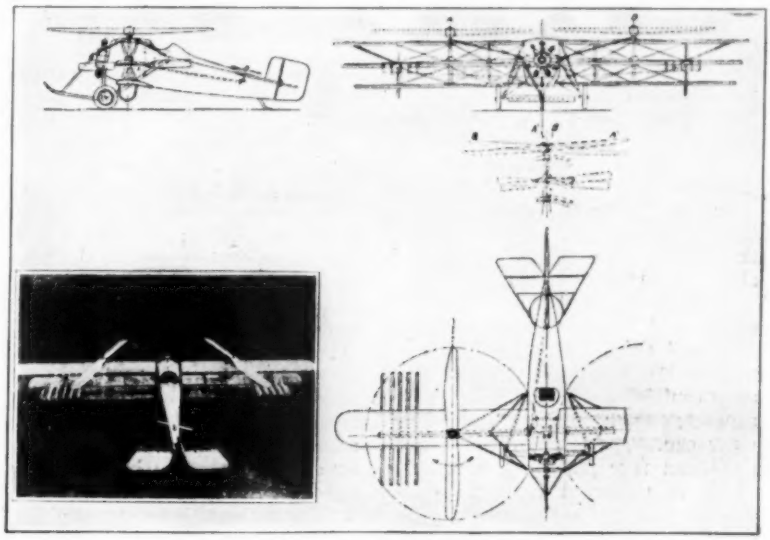
These two propellers on each of the upper wings serve as lifting propellers but as can be seen by the accompanying drawings their lifting power is greatly reduced by the wing surfaces which are used for horizontal flight. When the desired height is secured the plane is tilted and these propellers are used to give it horizontal movement. This machine weighs just 50 pounds short of a ton with dead load and fulfills one of Prof. Klemin's requirements in that it can be brought to earth safely with "deadstick," something few others can do.

But the machine has not been an absolute success. The last records available on its performance showed that its flight duration was but one minute and 35 seconds with a ceiling of 15 feet.

Perhaps one of the best of the helicopters is the aforementioned Pescara helicopter which holds the altitude record. Pescara has used this machine as the basis for a new and, what he predicts will be, a successful helicopter to be demonstrated in the near future.

His machine is very small and contains an undercarriage above which four four-bladed propellers are mounted on a single axis driven by a motor in the body of the machine. His machine embodies the principles of the Froude Momentum Theory more fully than the others but has the danger factor present and also low lift power. There is nothing except a small carriage beneath the blades.

But for satisfactory flights another French machine, the Oehmichen helicopter, is undoubtedly one of the most successful. This machine has made nearly 500 flights—some of these as high as 35 feet. Its most unusual feature is its perfect stability. It can also be maneuvered with ease. These are valuable assets, indeed. The Oehmichen machine is shown in an accompanying drawing. Its body is in the form of a cross, one arm being longer than the other. This long arm is used for longitudinal control. Lifting propellers are placed at the end of each of these arms. The engine, a nine-cylinder, 120 horsepower motor, is placed in the center of the crosses, and on the engine shaft is placed a gyroscope which has a velocity of 425 feet per second. There are several other smaller propellers about the machine to give more rigid control. The landing gear might also be noticed because of its peculiarity. But it is well suited to such machines as the helicopter. It consists of a series of six footballs at the end of shock-absorbing and pivoted struts. The machine weighs about 2,200 lbs.



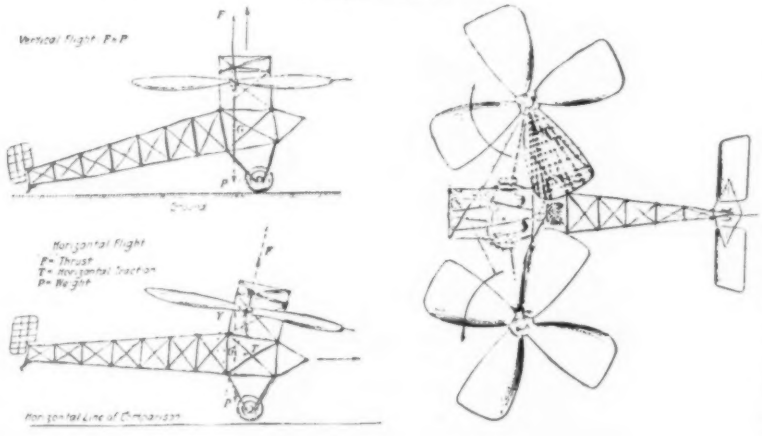
THE BERLINER HELICOPTER
The Berliner Helicopter embodies many characteristics of the airplane

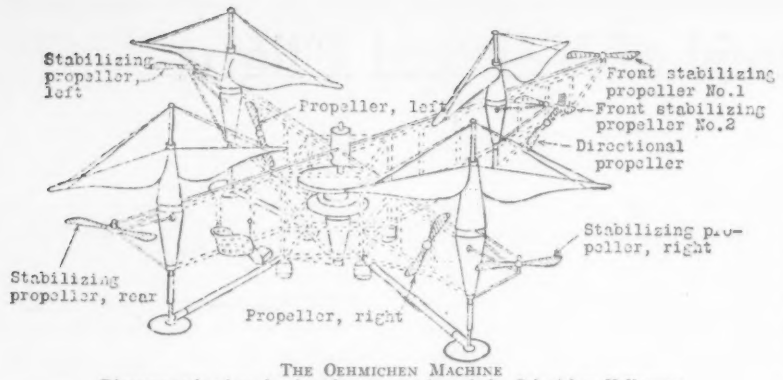
The Karman helicopter is another successful machine that deserves some mention. It consists of three arms, as shown in the drawing, each with a rotary engine which forces these three arms, constructed together, about in flight. Two propeller blades are suspended between these arms and the turret in which the flyer rests.

The De Bothezat helicopter is another machine of some note. It was first flown on October 19, 1922. On April 17, 1923, with Colonel Thurman H. Bane as pilot, a four man flight was made, with three men hanging on the machine. Between these two dates it has made more than 50 flights. However as in the case of others no descent with dead engine has been attempted.

This machine is provided with four lifting screws, each of 26½ feet diameter, four-bladed, with wide blades, five feet at the tip, giving a total blade area of 900 square feet. Although each blade screw was designed for a lift of 1000

THE DAMBLANC MODEL
This machine has never been flown, but engineers are interested in the principles involved





THE OEHMICHEN MACHINE
Diagrammatic view showing the construction of the Oehmichen Helicopter

pounds tests were conducted with a 1500 pound thrust.

Its weight empty is about 3400 pounds and a useful load of half a ton has been carried. When the helicopter is in operation two-thirds of its weight is rotating and about one-third is stationary. The overall length is 65 feet; the width is the same and the height is about ten feet.

A central frame member supports the engine and four outwardly extending structural arms, built up of duraluminum and steel tubing. One of these arms contains the pilot's seat and each supports one of the lifting screws at its outer end. The engine drives a main shaft and four jackshafts, to each of which is connected a turret driven through ring and center gearing. The engine also drives two four-bladed propellers of the reversible-pitch type, one being rotated at each side of the pilot and facing forward so as to give a forward thrust.

Another machine, the Damblanc helicopter, will also bear mentioning. It has never been flown for some unknown reason but its design has been of great interest to engineers. The first machine made was wrecked in ground trials and the present model has not been flown. Two lifting airscrews are used over a fuselage much like that of the modern airplane. They are driven by cables from two Le Rhone 110 horsepower engines. The drive is so arranged that either or both the two engines can operate both lifting airscrews. An automatic clutch and an elastic shock absorber are embodied in the transmission. Control is secured by a mechanism for warping the blades which are built much like airplane wings, a horizontal stabilizer and a vertical rudder are also used.

These machines offer much room for speculation. The helicopter is worth developing for there are great possibilities in such a machine.

For one thing it would solve the problem now confronting air transportation in the time lost between landing fields and city destinations by being able to land passengers on a space no bigger than the helicopter itself and likewise it would be able to take off from the same space.

Prof. Klemin predicts that the day of the helicopter's development is not far off. He asserts that three lines of development are open: (1) the combined helicopter-airplane; (2) the multiple-engined helicopter; and (3) the helicopter with gliding ability by virtue of windmill action of the reversed pitch airscrews.

Helicopters offer a fascinating study to aeronautical engineers and many have put their hobbies into attempting to solve the riddle of vertical flight. Its solution is not far off. When a propeller of sufficient adaptability can be designed success will be near.

"The combined helicopter-airplane (of which the Berliner is an example) is a thoroughly practical proposition," Prof. Klemin once said. "Since descent with engine dead is taken care of by airplane wings, comparatively small airscrews need be provided. This means general compactness of design and ultimately good efficiency in forward flight."

This type of aircraft is, of course, not likely to be very efficient in vertical climb, since it will have a very large wing surface resisting upward motion. The climb of the helicopter-airplane is analogous to that of the airplane itself. Not only the Berliner but the De Cierva autogiro is an excellent example.

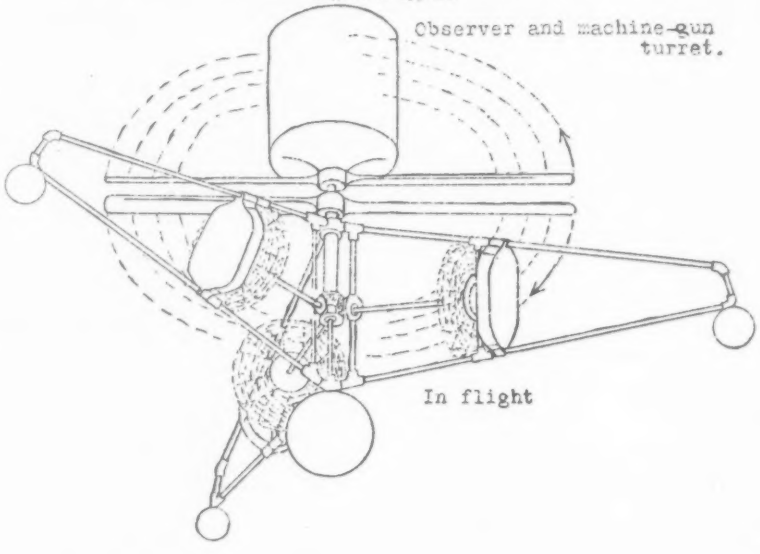
Since Harold Pitcairn, of Pitcairn Aviation, has secured American rights for the Spaniard's machine America will undoubtedly witness several of these autogiros in action. One has already been brought to America and used in the tests. To those readers who are confirmed moviegoers Fox Movietone News recently showed sound pictures of the autogiro in flight, landing, descending and hovering.

The future of the helicopter depends upon the earnestness and enterprise of the men who are now engaged in experimentation upon it. At present it offers very litle compensation in a monetary way. The engineer must go at the work for the love of it. Actually, helicopters, despite their vast possibilities and value, have never been studied very seriously, mostly because of the general satisfaction with the existing type of airplane.

The helicopter is not likely to equal the airplane in speed or in carrying capacity. Owing to the large airscrew diameters required it is not likely to be compact or maneuverable. The future of the helicopter does not lie in direct competition with the airplane. Its future is in its ability to perform certain functions that the airplane cannot undertake.

"The helicopter is within measurable distance of achievement and is worthy of serious consideration," Prof. Klemin has also stated. This would seem to be the last word in the matter.

THE SUCCESSFUL KARMAN
Diagrammatic view of the Karman showing how power from the three engines is applied

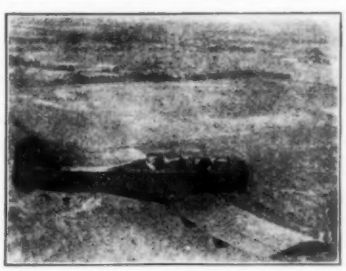


AN AVIATOR IN THE MAKING

1. Howard Boggs, Marshall Flying School student, leaving home early in the morning. Our students live in the fine private homes for which this old Southern town is noted.

2. Leaving for the Field in our privately operated station wagons—after breakfast with the "gang."

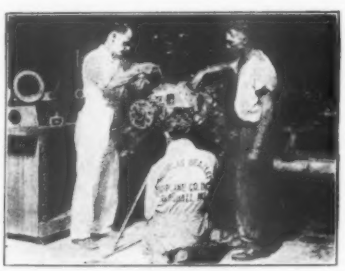
3. At Marshall Flying Field—"going over" all-metal structured Barling NB-3, the New Day Plane.

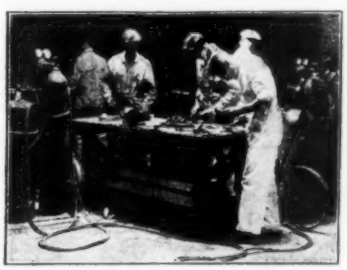


4. Howard is receiving final instructions before taking off in the famous NB-3, that flew from Brownsville, Texas to Winnipeg, Canada—1650 miles in 16 hours.

5. Howard and his instructor in the air—experiencing the thrill of a real "bird-man."

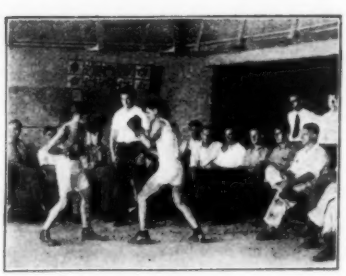
6. After lunch, a session in the classroom where highly trained instructors lecture on the theory of Aerodynamics and kindred subjects.





7. In the laboratory, Whirlwind Motor instruction. Howard is also learning about many other radial type, air-cooled and V-type, water-cooled engines.

8. (center) It is mid-afternoon and Howard is welding—a real necessity in modern all-metal construction.



9. No phase of aviation is overlooked at Marshall. (above) Howard is studying aviation salesmanship and exporting—training for the executive positions in the industry.

10. Boxing matches, banquets, swimming and other recreations round out the student's life at Marshall, and help make this original "College of the Air" America's most popular flying school.

Send Today for Additional Literature!

MARSHALL FLYING SCHOOL, *Inc.*

Join the Marshall Flying Association.

Write for details.

The Original College of the Air

Affiliated with Nicholas-Beazley Airplane Co., Inc.

116 N. English St.

MARSHALL, MISSOURI

Welding Course	$ 95
Mechanics	95
Primary Aviation	250
Private Pilot	450
Limited Commercial	875
Transport	2500

Mr. N. Souther—Marshall Flying School
116 N. English St., Marshall, Missouri

Dear Mr. Souther—Please send me more information on the "College of the Air."

Name _____

Address _____

Jim Kelly didn't "wait until tomorrow" . . .

"Cowboy" JIM KELLY, *who gained world fame as a great flier and mechanic less than a year after he enrolled at T-A-T.*

THE world-famous Jim Kelly, who, with Reg Robbins blazed the trail for endurance fliers in Commercial air craft—proved to airline operators and an air-conscious public the value of T-A-T training. *Kelly proved that T-A-T Graduates have more than flying hours, have more than "theory," have more than training.* He proved to careful operators what they have long known, and to a cautious public, that T-A-T graduates have that "priceless ingredient" . . . *experience* as a part of their training. The sort of experience that made it possible for Kelly to meet every emergency—to take his turn at the stick—to journey confidently out on the flimsy catwalk to grease the rocker arms and make delicate engine adjustments as the propellor grazed his belt. When Jim Kelly, a former T-A-T Flying School student, blazed this trail he proved the value of T-A-T training!

Operators and the Public Demand Thorough Training

It is training such as Kelly received that operators and the public demand of its pilots to carry the U. S. mails, express and precious human freight. Earn a T-A-T diploma and you carry with you the confidence of operators and the public. T-A-T is the private school of one of the nation's largest airline operators. T-A-T is the school that produced many of the pilots, mechanics, field men and executives who have made possible the marvelous record of the five related T-A-T companies . . . a record of more than one million, five hundred thousand air miles without loss of a single piece of mail or injury to passenger or pilot!

Only Thoroughly Trained Pilots Need Apply

You must have thorough training if you want to make good in Aviation. For neither operators nor the public will guess at your ability. They MUST be sure that you are thoroughly trained. Your T-A-T diploma will prove that—will prove that you have had the same thorough training that Kelly had. Only the most thorough, the most complete, the most painstaking instruction could have made possible Kelly's record. And Kelly was green *—he did not know the feel of a stick less than a year before the flight!* That's thorough training.

You Can Get the Same Thorough Training Kelly Had

The training that made Kelly the pilot and mechanic that he is, is open to you at T-A-T. Veteran Pilots will teach you the tricks of the trade, just as they taught them to Kelly. The same Licensed Mechanics will supervise your mechanical training. You will be one of a small class, just as Kelly was. Your instructor will be your friend and you will receive the same personal instruction Kelly received. You will meet Jim Kelly, a member of the T-A-T family, and talk to him frequently. You will train in new, safe training planes—and they are many and varied—just as Kelly did. You will be in close touch with the same opportunities that were open to him in the heart of important commercial aviation activities. You will get *experience* as you learn. And with your diploma there will be a prestige that money cannot buy . . . only thorough training will earn it for you.

HANK KILLHAM another cowboy whose thorough training at T-A-T makes him a valuable executive in the New Orleans division of Southern Air Transport, Inc., a related company.

Take the Step Jim Took— Take It NOW

If Jim Kelly had "waited until tomorrow" to write for our book, he may not have been the world famous flier he is today. He had decision, and took the first step. You too should take your first step TODAY, and write to T-A-T Flying School, just as Jim Kelly wrote little more than a year ago. Our illustrated 32-page book, "Flying the Golden Trail," may bring you fame and fortune equal to Jim Kelly's. It may not. But it will surely show you the way to a position in Aviation that will bring you the admiration of all your friends and a high salary as well. Send the coupon TODAY. "Flying the Golden Trail" is free.

T-A-T Flying School, Inc.

Fort Worth Dallas Houston San Antonio Amarillo New Orleans Atlanta

T. A. T. Flying School, Inc.,
627 Fort Worth National Bank Building,
Fort Worth, Texas

I'd like to know how I can take the same courses which gave Jim Kelly his training and flying experience.

Name..... Age.....

Address..... Occupation.....

Learn AVIATION WHERE LINDBERGH STARTED!

This Is Now One of the Largest and Finest Equipped Schools in the U.S.

STARTING as a small school back in the days when "Lindy" was training here, the Lincoln Airplane School is now one of the largest, best-known and finest-equipped aviation schools in the United States—with more than $350,000.00 worth of buildings and equipment, including two modern flying fields. And is famous in every factory and airport as the school that turns out thoroughly-trained mechanics and flyers.

You Don't Have to Fly—Ground Men Make Big Money!

We emphasize Ground Training. Our course in ground work is practical and complete. You learn to become a dependable airplane mechanic or aircraft builder. Also complete aircraft welding courses.

At Lincoln you will train just as though you were a worker in an actual factory or a commercial airport. You work on real planes. Construct, repair and rebuild wings, fuselages, landing gear—every part of a plane. You work on various popular types of aero motors—learn to take them apart and put them back together. We emphasize instruction on the famous Wright Whirlwind engine, navigation and meteorology. Lincoln is one of the few schools actually using a Wright Whirlwind for students to overhaul.

We Make You a Safe, Dependable Flyer

You start flying the day you enroll. A Government licensed transport pilot takes you up into the sky in one of our dual control licensed planes. As you progress you learn straight flying, climbs, banks, turns and emergency landings, until, before you realize it, you are flying solo. Then you learn cross country flying, acrobatics, etc.

LINCOLN AIRPLANE SCHOOL

Where LINDBERGH Learned

230 Aircraft Bldg. Lincoln, Nebr.

Students Working on Various Types of Aero Motors

Lincoln Instructors and Planes Carry U. S. Dept. of Commerce Licenses

All Lincoln pilots and ground instructors and training planes are *approved by the Aeronautical Division of the United States Department of Commerce.* Each carries the Department of Commerce license. *Already we have officially applied for examination and rating by the Department of Commerce.*

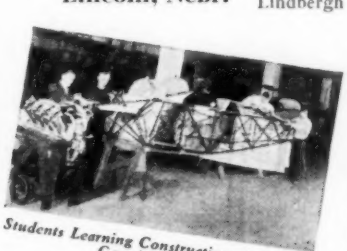
Students Completely Satisfied

The Lincoln Airplane School has never misrepresented. Although students have expressed disappointment about some flying schools, *all Lincoln students are more than satisfied,* and boost this fine school to their friends. We have students from 25 states, several from Canada, two from Alaska. Others from Europe and South Africa.

Low Tuition—No Advance Payment

Lincoln tuition is low. We help our students get part time jobs. In enrolling, send no advance payment. You should personally inspect any school before you pay a cent. This school will stand the most rigid investigation. Mail Coupon at once for complete information and the Story of Lindbergh at Lincoln!

He Just Landed After His First Solo



Students Learning Construction of Engine Carrying Frame

MAIL COUPON NOW!

Lincoln Airplane School
230 Aircraft Bldg., Lincoln, Nebr.

Dear Sirs: Please send me at once FREE Literature containing full information about mechanics, builders, welders and pilots courses; low tuition; the Story of Lindbergh at Lincoln, etc.

Name ..... Age .....

Address .....

City ..... State .....

Condensed News of the Month

(Continued from page 52)

of landing gear, standard wheels, skis and pontoons, and will be used in exploring new whaling grounds along the ice pack in the sector between Falkland dependencies and South Africa. A spare Wright engine and parts will be shipped to the base in the Antarctic.

◆

Cavalier Introduced to Indiana

The new Cavalier sport monoplane was introduced to Indiana recently when Aero Agents Company, of Chicago, sent the plane to five airports in four Indiana cities. Kenneth E. Griffith, general manager of Aero Agents, left Chicago shortly after noon and returned the same evening.

◆

Authorized P & W Service for Coast

The Aero Corporation of California announces that they have received the franchise for authorized service and parts sales on all model Pratt & Whitney engines in the territory including Southern California, Arizona, New Mexico and Texas. Twenty-four hour ship service will be offered at the fields of the Aero Corporation.

◆

New Catalogues

Among the month's catalogues are those of the American Aeronautical Corporation, which has the exclusive right to manufacture and sell Savoia-Marchetti seaplanes in North and South America, and a distinctively printed Travel Air booklet.

◆

Bendix Acquires Pioneer

America's oldest manufacturer of flight and navigation instruments has been acquired by Bendix Aviation Corporation through exchange of stock. This merger establishes the Bendix group as one of the largest in the accessory field.

◆

Ninety P-12's Ordered

The Army has just ordered ninety Boeing P-12 Pursuit planes at a cost of over $1,000,000, not including the "Wasp" engines with which the planes are to be powered. A commercial design of this ship is being offered for the sportsman. The planes will reach better than 170 miles per hour and can climb to 10,000 feet and back in four and a half minutes. Captain Eaker used this type of ship for his United States-Panama dawn to dusk flight.

◆

Criticizes Critics

A. F. Arcier, vice-president of General Airplanes Co., recently issued a statement that critics of recent endurance flights fail to take into account that these flights have done more to definitely prove the stability and durability of the airplane than any other contributing factor.

◆

Cirrus Offers Prize

Colonel R. Potter Campbell, President of American Cirrus Engines, Inc., Belleville, N. J., makers of the American Cirrus Mark III, light plane engine, offers a prize of $300.00 to the first woman student flyer to secure a pilot's license while flying any make of plane equipped with a Mark III Cirrus engine.

WHAT THIS PILOT KNOWS *for*—

CHIEF PILOT CLEVENGER, out of the wealth of his 10 years' flying experience, explains in simple, interesting language, every movement of the controls for take-offs, landings, straight flight and aerobatics in his nationally famous instruction book—"MODERN FLIGHT."

STUDENT PILOTS and young men about to enter the game can cut down the number of hours usually necessary before soloing through the wise investment of One Dollar.

HERE IS MY DOLLAR

Gentlemen:

Rush copy of Clevenger's complete flying course.

Name.....

Address.....

ALEXANDER AIRCRAFT CO.

Manufacturers of the Eaglerock

Room 419, Alexander Industries Bldg., Colorado Springs, Colo.

SAVES YOU $50

when you LEARN TO FLY

The ambition of every flying student is to be able to handle a ship alone in the least time possible. Purchase of Clevenger's "MODERN FLIGHT" is a long step in that direction.

All that you ought to know about AVIATION

A Comprehensive Course in every phase of this great industry COMPLETE IN TWO VOLUMES

JUST send this coupon for a five day study of the most comprehensive aviation course ever written—all to be known about the entire industry—condensed by an expert and comprehensively explained and illustrated in two magnificent volumes.

For Beginners, Experts, Students, Fliers, Mechanics, Builders and Owners
In *Modern Aircraft* and *Everybody's Aviation Guide*

Everybody's Aviation Guide
By Major V. W. Pagé
U. S. Air Corps Reserve

Teaches aviation from beginning. Gives and answers 600 important questions. Excellent for laymen and beginners. Gives complete information necessary for U. S. Government license. Explains every problem up to first trial flight. Indispensable to students and learners.

247 Pages. 140 Illustrations.
Price $2.00

MODERN AIRCRAFT
By Major V. W. Pagé
U. S. Air Corps Reserve

Used as authentic reference and text book in more than a hundred aviation schools. Invaluable to pilots, mechanics, and officials. Explains every aircraft detail—engines, instruments, flying, airports, modern planes, etc. Up to the minute. 855 octavo pages. 400 illustrations. 23 tables. Price $5.00.

Major Victor W. Pagé, a distinguished technical engineer, flier and instructor, gives from his years of experience all the information necessary in connection with modern aviation. 1102 pages. 540 illustrations. Two great books. The advanced flier uses them as an authoritative reference; more than a hundred schools use them for text books; beginners use them to get the background and groundwork necessary for an intelligent start in any branch of aviation.

Teaches the Flier and the Builder All the Facts

These two books should be the first and most important on every aviation bookshelf. They head the list of authorities. Examine them for five days. Make your own decision after you hold them in your hands.

Just Send the Coupon

Fill in the coupon and mail it at once. When the books arrive you will be so pleased with their comprehensive, clear and thorough treatment of the entire field of aviation that you will be convinced that they are an amazing bargain at this low price. Fill in the coupon and put it in the mails right now!

Enclose No Money

This convenient coupon brings either one or both of these books to your door. Look them over for five days. If you are not thoroughly delighted with their wealth of information, return them to us at once for a complete refund.

NORMAN P. HENLEY PUBLISHING COMPANY
2 West 45th St., New York

Tear off along this line and mail NOW!

NORMAN P. HENLEY PUB. CO.,
Dept. P. A. 929
2 West 45th Street, New York

Send me your books, MODERN AVIATION and EVERYBODY'S AVIATION GUIDE. Upon delivery, I agree to give the postman $7, plus the delivery charges. It is understood that I have the privilege of 5 days' examination. If within that time, I am not entirely satisfied, I will return the books and you will refund my money in full. Otherwise I will keep the books and not pay you another cent.

☐ Check here if you want both books, $7 plus delivery charges.
☐ Check here if you want only MODERN AIRCRAFT, $5 plus delivery charges.
☐ Check here if you want only EVERYBODY'S AVIATION GUIDE, $2 plus delivery charges.
☐ Check here for catalogue of all Henley Publications.

Name .....
Address .....
City .....
State .....

☛ *If you enclose your remittance, we will pay the postage ourselves.*

MONTEITH

CLARK

E. T. JONES

B. Q. JONES

KLEMIN

DIEHL

HANKS

Practical Books for Every Need Written by Leading Experts

No matter what the branch of aviation on which you want information, it is always worth while to turn *first* to the books of the RONALD AERONAUTIC SERIES. Here are books to meet every need. Whether you are a student pilot or a veteran flyer, a mechanic or a designer, an airport manager or an investor in aviation securities, no matter what your interest in aeronautics may be, you will find information that you can put to practical use among the twenty-two volumes now ready in this famous series. Thousands of copies are in use in government and private flying schools, and in leading technical schools, colleges, and universities. Space permits us to list less than half of the books available, but those described will show you the wide range of topics covered.

Simple Aerodynamics and the Airplane

***by Charles N. Monteith**, Chief Engineer, Boeing Airplane Co.; 3rd edition revised by Colonel C. C. Carter, U. S. Military Academy, West Point.* **418 pages, 211 illustrations, $4.50**

A completely revised and enlarged edition of a famous introductory textbook widely used in ground and flying schools, in colleges, technical schools and universities. It is ideally suited to home-study use.

Includes a general discussion of airplanes; characteristics and types of airfoils; explanations of lift and drag; center of pressure and its movements, plotting of coefficients and characteristic curves; distribution of forces; selection of airfoils; rate of climb; landing speeds; combining air foils; parasite resistance; characteristics of aircraft engines; discussion of component parts of an airplane; stability considerations and its attainment; control surfaces; the propeller; airplane performance; dynamic loads, maneuverability and controllability; structural considerations; wind tunnels; discussion of airplane types for specific performance, methods and instruments for navigation of aircraft; airplane accessories; parachutes; radio; aerial photography; etc.; etc.

International Airports

***by Stedman S. Hanks**, Lt. Colonel, Air Corps Reserve.* **195 pages, 48 illustrations, $5.00**

Colonel Hanks describes in detail the design, construction and management of leading foreign airports and compares them with well-known American airports.

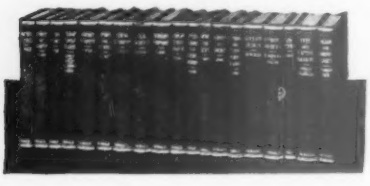
He points out how American airports may secure substantial additions to revenue by adapting ideas that are in profitable use abroad. Among the subjects discussed are passenger facilities at airforts; tickets; baggage regulations; German development of combination air and rail service for express shipments; an outline of an ideal airport combining the best features of American and European airports; specimens of foreign air travel publicity material; etc., etc. Numerous forms are reproduced and translated.

Aircraft Power Plants

***by E. T. Jones**, Chief Engineer, Wright Aeronautical Corporation; and other experts.* **208 pages, 104 illustrations, $4.25**

The section on aircraft engines and accessories explains and compares the various types of engines without going into thermodynamic formulas. The adaptability for specific purposes is carefully pointed out, with practical notes on operating features supplemented by many diagrams. Covers ignition systems, carburetors, radiators, fuel piping, pumps, reversing mechanisms, superchargers, lubrication and quality of engine fuels, etc., etc.

The section on design and construction of propellers explains clearly and concisely the principles of air propellers. Formulas, data, and planforms sufficient for design of ordinary types are included.



Airplane Stress Analysis

***by Alexander Klemin**, Professor of Aeronautical Engineering, Daniel Guggenheim School of Aeronautics, New York University.* **277 pages, 105 illustrations, $7.00**

In this introductory treatise, Professor Klemin shows step by step how to make all the calculations in the airplane stress analysis required by the Department of Commerce. The book is intensely practical—each point is explained with the utmost clearness and simplicity; advanced methematics has been avoided so far as possible. To show the reader just how the calculations are made in actual practice, Professor Klemin takes an airplane of average characteristics and gives full examples of all the computations required. A preliminary review explains the principles of applied mechanics involved. In concise, easily usable form, data on materials of aircraft construction to which the calculator must frequently refer, are assembled for convenient reference.

Engineering Aerodynamics

***by Walter S. Diehl**, Lieutenant (C.C.), U. S. Navy, Bureau of Aeronautics.* **288 pages, 159 illustrations, $7.00**

Provides practical information on aerodynamics, presented in forms suitable for direct application by aircraft designers and students of aeronautical engineering.

Lieutenant Diehl shows how the modern theories of lift and drag are applied to everyday design problems. He gives detailed methods for calculating and estimating performance; making performance tests and reducing observed data to standard conditions; how to conduct and interpret wind tunnel tests; how to interpret model test data; design of control surfaces; test data for a number of standard wing sections with methods for selection of an airfoil to meet a particular purpose; flap and aileron test data, etc., etc. A chapter on parasite drag includes selected data on struts, wires, fuselages, streamline bodies, etc.

Practical Flying

***by Major B. Q. Jones**, Air Corps, U. S. A.* **210 pages, 6 illustrations, $3.00**

The author is a famous Army flyer who has trained thousands of pilots. The book provides clear and concise answers to the hundreds of questions that student pilots ask. A variety of practical subjects is covered, such as the most useful instruments for each class of flying, particularly "blind" flying; why a magnetic compass spins during fog flying; "dead stick" landings; etc. Major Jones explains in detail the causes of crashes during take-offs and turns for landings; how to recognize stalls in time and correct for them; how stalls progress into spins and how to get out of them easily.

Elements of Aviation

***by Colonel V. E. Clark**, formerly Chief Aeronautical Engineer, U. S. Army,* **193 pages, 24 illustrations, $3.00**

This book by a world-famous aircraft designer explains clearly and simply why an airplane flies, why it is stable or unstable, controllable or uncontrollable, in various attitudes and conditions—in short, "why an airplane does what it does."

Colonel Clark explains all the phenomena encountered during airplane flight in a thorough yet readable way, and without complex mathematics. He shows that a few fundamental principles of elementary physics (which are explained in detail), when properly understood and applied, account for everything that can happen to an airplane in flight as regards stability and control.

Aeronautical Meteorology

***by Willis Ray Gregg**, Senior Meteorologist, in Charge of Aerological Division, U. S. Weather Bureau.* **144 pages, 44 illustrations, $2.50**

Presents practical information in concise, usable form to meet the needs of pilots and executives of air transport companies.

Among the subjects included are: how to read weather maps; using local observations for immediate forecasts of probable flying conditions; weather forecasting from clouds; the average height of clouds of each class; the variation in direction and velocity of winds with change of altitude; the frequency of winds from each direction at various altitudes; the characteristics and dimensions of thunderstorms; general circulation of the atmosphere; visibility; instruments and methods of observation; cyclones and anti-cyclones; weather map making and reading; distribution of weather forecasts by radio, etc., etc.

(fill in, tear out, and mail)

Sent Postpaid and Without Advance Payment for Your Examination

The Ronald Press Company, Publishers
Dept. M187, 15 East 26th St., New York

Send me, delivery charges prepaid, the books I have checked below. Within five days after I receive them, I will return any I do not wish to keep and remit for those I retain.

- ☐ *Monteith-Carter*, **Simple Aerodynamics and the Airplane** $4.50
- ☐ *Hanks*, **International Airports** 5.00
- ☐ *E. T. Jones*, **Aircraft Power Plants** 4.25
- ☐ *Klemin*, **Airplane Stress Analysis** ... 7.00
- ☐ *Diehl*, **Engineering Aerodynamics** .. $7.00
- ☐ *B. Q. Jones*, **Practical Flying** 3.00
- ☐ *Clark*, **Elements of Aviation** 3.00
- ☐ *Gregg*, **Aeronautical Meteorology** ... 2.50

Name .....
(Please PRINT to insure correct delivery)
Home Address .....
City ..... State* .....
☐ Rank (if in Army or Navy),
☐ Employed by,
☐ or Reference .....

**On orders from outside continental U. S. and Canada, cash plus 25 cents per book to cover shipping.*

☐ Check here if you wish complete list of Ronald Aeronautic publications, free.

The Monthly Financial Review

By T. Allen Grover

THE month just past has witnessed an amazingly strong market which has confounded both bulls and bears—though for obviously opposite reasons. The most astute students hesitated to predict the course of events over the trying period of mid-year settlements, which was emphasized by enormous demands on the money market for funds in connection with "rights" of several of the country's largest corporations. But the money pinch failed to materialize and the numerous averages of industrial and rail stocks compiled by various financial agencies reached new all-time highs.

In this boiling market public utilities and railroads took the leadership. The former came into accumulation because of various merger possibilities and the latter because traders favored them as an unexploited group, and investors saw in their increasing earnings, opportunities for a good return as well as possibilities of principal appreciation.

It was only natural that with all eyes focused on these two classes of securities that aviation stocks, as a whole, should occupy little of the attention which has been given them in the last half year, and trading in the principal aeronautical securities has been comparatively quiet with few important price changes, either one way or the other.

The lack of public interest has not been a bad thing for the aviation securities market, however. It has allowed groups operating in the various stocks to consolidate their position and has given a healthy breathing space to this class of security which has, frankly, been somewhat over-emphasized during the last year.

Public enthusiasm for the nation's newest industry is bound to rise again and the period of quiet which we are now witnessing is a lull before renewed activity which, we believe, will come before the end of the year.

The month has not been without its constructive developments. The two most important are perhaps the merger of the Curtiss-Keys and Wright-Hoyt interests, and the actual operation of the long planned and carefully organized transcontinental air-rail service of Transcontinental Air Transport, Inc.

New Companies

General Aviation Corporation—This is a new investment trust formed by prominent financial men in Southern California to buy and sell aeronautical securities and also to hold controlling interest in operating companies. Negotiations are under way for the purchase of an aircraft motor company, an airplane manufacturing company and an airport and flying service, although none of the units which will go to make up this consolidation have been announced as yet. De Respins & Company of Los Angeles are offering 100,000 shares of the authorized 500,000 no par common stock at $5 per share.

Fairchild Aircraft, Ltd.—This company has been organized in Canada with an authorized capital of $2,000,000, $100 par value, 6 per cent preferred stock and 43,000 shares of no par common stock for the purpose of manufacturing Fairchild airplanes in Canada. The company is in effect a subsidiary of the Fairchild Aviation Corporation of New York and is an outgrowth of their former Canadian company called the Fairchild Aerial Surveys of Canada, Ltd.

Hawaiian Airways Company, Ltd.—This company has been formed in California with backing of Coast capitalists and their Hawaiian associates for the purpose of operating an aerial service for passengers and light freight in the Hawaiian Islands.

Capitalization of the company consists of 100,000 shares of Class A stock of which 50,000 shares will be offered at $10 per share. The company has placed an order with the Fokker Aircraft Corporation for two 14-passenger planes which they expect to operate in September.

Cord Corporation—This company has been formed under the laws of Delaware with a capital structure consisting of 10,900,000 shares of $5 par common stock. E. L. Cord, president of the Auburn Automobile Company, has announced that this concern, which is also the manufacturer of Lycoming engines, will be merged with the new company and that plans are being made to manufacture a front wheel drive automobile as well as several varieties of airplanes for aircraft motors.

Aviation Consolidated, Inc.—This company, of which Major Lorillard Spencer is president, has taken over the activities of several aviation companies, operating in and about Palm Beach, Florida, and Lake Placid, New York, with plans to operate transport service between New York City and these points.

St. Louis Aviation Corporation—This is a new Delaware Corporation formed largely by St. Louis interests to act as an investment trust in the field of aeronautical securities. 150,000 shares of no par capital stock are being offered at $22.50 a share. Among the directors are such men as Mr. C. M. Keys, Mr. J. C. Cowdin and Mr. Richard F. Hoyt of the Curtiss-Wright interests.

Mergers and Consolidations

The Curtiss-Wright Corporation—After a flood of rumors which had connected the Wright Aeronautical Corporation with numerous interests, both in the financial world and in the motor industry, a fairly complete surprise was afforded by the announcement that the Curtiss Aeroplane and Motor Company and its subsidiaries and the Wright Aeronautical Corporation and its affiliated companies would be merged into one gigantic holding company to be known as the Curtiss-Wright Corporation.

This forms, today, the largest aeronautical company in the world and includes every variety of products, ranging from small, radial motors to gigantic 600 h.p. water-cooled power plants, and from tiny training planes to navy bombers and flying boats. In addition to these manufacturing interests, there are included in the merger companies controlling airports, flying schools and sales organizations throughout the United States and abroad.

The capitalization of the Curtiss-Wright Corporation consists of 12,000,000 shares of no par value stock, of which 2,000,000 will be called Class A stock and will be entitled to a non-cumulative preferential dividend of $2 per share annually. The remaining 10,000,000 shares will be classified as common stock. Both classes of stock will have equal voting privileges, one vote for each share. The Class A stock is callable at any time at $40 per share and is exchangeable share for share with the common stock.

The companies which have received an offer to exchange their stock for that of the new holding company are listed below with the exchange ratio given for which their shares may be traded for the shares of the Curtiss-Wright Corporation.

As all of the companies mentioned are practically controlled by either the Curtiss Aeroplane and Motor Company or the Wright Aeronautical Corpora-

(Continued on page 86)

Continued Leadership—
AFTER 27 YEARS OF SUCCESS!

Naturally, the Greer Aviation Student Has the Greater Advantages!

YOUR success in Aviation depends upon the experience of the School which gives you your first training.

Experience, prestige and success come only to those who have themselves learned what to do—and how to do it—correctly. These qualities cannot be acquired in one year or five years, yes, even ten years. It takes a lifetime of study and effort!

Only Greer College can offer you the experience of 27 years of active, successful training methods.

Only Greer College can offer you the equipment a thorough training demands—12 floors of machinery, motors, classrooms, assembly shops, and materials. Of course, training planes and flight instructors are licensed by the Government.

Only Greer College needs to make use of three Airports within the boundaries of Chicago.

Only Greer Students have the advantages that Chicago, the "Air Capital of the United States," can give them—the world-famous Municipal Airport, about which are grouped the hangars of every famous transport company in the East and Mid-West—endless varieties of industries are here, both in the field of Aviation and out of it. Here, if anywhere, are the greatest opportunities for the graduate.

You clear visioned, ambitious and air minded young men deserve the best advantages a training school can offer you. Obviously, the Greer Student has the greater advantages.

Before you turn this page, clip the coupon in the lower right hand corner and send for your copy of "Winning Your Wings," the true story of a dependable school of Aviation!

(Inspection and Rating by U. S. Dept. of Commerce Applied for.)

One of These Greer Aviation Courses Will Meet Your Demands!

Pilot's Ground Course
This course is intended for those who wish a thorough training in the first principles of flying, with the intention to fly as soon as possible.

Airplane Construction and Motor Mechanics' Course
This is the most complete course in ground work offered by any school, meeting Government standard.

Pre-Solo and Private Pilot's Course
This course is the first step toward a Government License and includes 10 hours dual flying if necessary, and 10 hours solo. These courses can be taken separately.

Limited Commercial or Industrial Pilot's Course
This is the next step forward to a more valuable Government License. 50 hours of solo and necessary dual flying.

Transport Pilot's Course
This is the course which will prepare you to receive a Government Transport Pilot's License, upon passing an examination. 200 hours of advanced flying under all kinds of conditions.

Special Advantages!
Railroad or bus fare allowed to Chicago to students who pay for their courses in advance.
FREE EMPLOYMENT SERVICE—Help to all Greer Students during their training period.

Greer College
2024 S. Wabash Ave.
Dept. 9-J CHICAGO

MAIL THIS COUPON—TODAY

GREER COLLEGE, Dept. 9-J
2024 S. Wabash Ave., Chicago, Ill.
Please send me free your big Aviation book and full details about your Training and Employment Service.

Name .....
Address .....
City ..... State .....
Age ..... Occupation .....

Future Events

August 24-September 2—National Air Races and Aeronautical Show, Cleveland, Ohio. Cliff Henderson is managing director, and has been named to have charge of future expositions sponsored by the Aeronautical Chamber of Commerce. The exhibits will be at the Cleveland public auditorium and the Races will be held at the Municipal Airport.

September 6-7—Schneider Cup Race, Cowes, England. So far the United States has no official entry, though it is understood Alford Williams is being privately backed.

September 28—Gordon Bennett Balloon Trophy Race, St. Louis, Mo.

October 5-21—National Air Tour for the Edsel Ford Trophy, covering approximately 4,400 miles, with stops tentatively arranged at Windsor, Toronto, Ottawa, Montreal, Portland, Boston, New York City, Philadelphia, Baltimore, Richmond, Charlotte, Greenville, Savannah, Jacksonville, Macon, Atlanta, Nashville, Louisville, St. Louis, Kansas City, Des Moines, St. Paul, Wausau, Milwaukee, Moline, Chicago, Kalamazoo and Detroit.

October 12-27—Southwestern Aircraft Exposition, State Fair Grounds, Dallas, Texas.

October 15—Start of South America Trade Extension Flight, a five months' tour of over 40,000 miles through Latin and North America, sponsored by the American Manufacturers' Export Association.

SPRUCE STRIPS
All sizes and quantities
Perfect size and finish
Write us and save
AIRPLANE SPRUCE CO.
4044 N. Keystone Ave., Chicago, Ill.

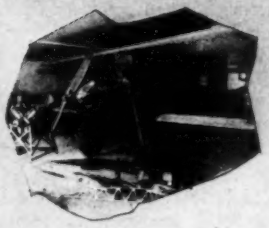
MASON, FENWICK & LAWRENCE
PATENT LAWYERS
600 F St., N. W., Washington, D. C.
Estb. over sixty years. Send sketches.
Electrical, Aeronautical and Chemical Inventions carefully handled. Practice before the U. S. Courts and the Patent Office. Prompt and careful service. Write us. Protect your inventions.
TRADE MARKS REGISTERED

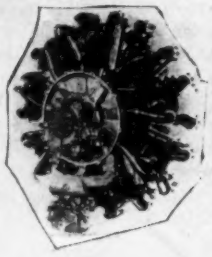
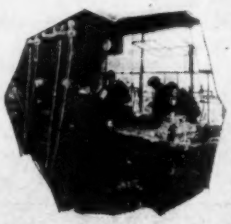
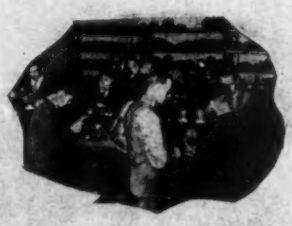
12-INCH SCALE MODEL

of Lindbergh's Spirit of St. Louis. Scientifically designed and very realistic. Equipped with rubber band motor. Rises from ground by own power and flies 40 ft. or more. Easily built without tools. Construction set, with all parts and full directions, postpaid in U. S., only 50c (no stamps). Satisfaction or money back. Send now.
MANN & BENTON, Box M, Chillicothe, Ohio

AVIATION EMBLEMS

Groundman or Mechanic *Civilian Flyer*
Made of silver or gold front (Actual size shown above). Pins or lapels. Price, $1.00 each, mailed anywhere. Identification Wristlets, $2.50
JOHNSON COMPANY
—ORIGINATORS—
Flying Schools, Clubs, Army, Navy, Manufacturers
Souvenirs for Airport Openings. (Special designs submitted)
352 WEST 13th ST. "WING BUILDING" NEW YORK
WRITE FOR CATALOGUE F



In the profession of flying — every successful mechanic, pilot and navigator must know thoroughly the physical fundamentals and mechanical intricacies, and how to apply this knowledge to practical purposes. There is no surer or better way than by entering

The BEDFORD YMCA AVIATION MECHANICS SCHOOL

Sponsored by some of the most famous figures in Aviation.
Offering a complete, practical course in Aviation Principles and Mechanics, with many unusual advantages for air-minded men.
The Bedford School is located within forty-five minutes of Curtis, Mitchel, and Roosevelt Fields. Twenty nearby airplane factories are visited regularly by supervised groups.
Our shops are equipped with one-half million dollars' worth of modern machinery and mechanical appliances.
Fifty per cent of our students are employed before completing half the course—a remarkable record showing a reputation in Aviation circles as an institution of efficient instruction.
There are comfortable dormitory facilities for our out-of-town students—with the use of a spacious Gym and a modern Pool.
Tuition may be paid in easy installments. Day and evening sessions.

SUCCESS COUPON—MAIL NOW
THE BEDFORD Y. M. C. A.
AVIATION MECHANICS SCHOOL
1115-1125 Bedford Avenue
Brooklyn New York City
Please send me free illustrated Pamphlet 71.
Name _____
Street _____
City _____ *State* _____

The Compressed Air Motor Assembly

By Bertram Pond

THE powerful little compressed air motor is all that is necessary to complete the compressed air model which has been described in two previous issues. The first issue dealt with the construction of the compressed air tank. You should now have this made and tested, ready to install in your model. The second article described the manner of making the simple wing and fuselage for this air model.

In this issue the assembly of the motor and the joining of the units together along with hints for flying will be taken up step-by-step.

Remember, there is an event for compressed air models for which AERONAUTICS is donating medals in connection with the Third Annual Contest of the Recreation and Playground Association of America to be held at Louisville, Kentucky. Details of this contest were printed in the May issue.

Before starting to work on your air motor look at the picture of the fine compressed air model made by Tudor Morris, the winner of an AERONAUTICS' gold medal and holder of the World's Hydro Record of 12½ minutes made at the Playground Contest at Atlantic City. His fine air model is practically identical to the one we have described in the model section. The model shown in the picture flew on just a test flight with low pressure in the tank for a distance of about 300 to 400 ft. with a duration of close to 30 seconds. It has made other farther and longer flights. Morris, you will remember, placed second in the compressed air model event at Atlantic City, thereby winning one of AERONAUTICS' silver medals for compressed air models.

Morris states that the building of a compressed air model, outside of the tank and motor, is really easier than building a rubber driven duration model. Rassner, winner of first place in the compressed air event at Atlantic City writes, "Don't forget to say that air is a lot cheaper than rubber."

With air as cheap as it is and because of the simplicity of building an air model, let's get busy now and see how many air models we can have at the National Contest at Louisville.

Constructing the Air Motor

Numerous air motors were examined and tested before selecting a suitable motor for this machine. Compressed air motors used in England and Germany were examined and studied, and a number of books describing compressed air motors were examined to determine the type best suited for a model of this type. Lightness had to be combined with strength, power, speed, efficiency and low cost of materials.

The Hoosier Whirlwind fills just a few more of these requirements than any other available motor. It is a motor very easy to assemble, it weighs only seven-eighths of one ounce and has made some wonderful flights on the busy end of a compressed air model.

Though the Model Editor has complete data on the construction of the parts, very few people, if any, would be equipped to make the parts themselves. In fact, it would be like a jeweler attempting to make the parts for a watch. However, the jeweler has no trouble in assembling the watch once he has the parts. Consequently, you should have very little trouble in putting this air motor together, especially with the following helps.

The only tools that you will need for this work are:

A small fine tooth file.

A small hand punch or even a small nail filed sharp will do.

A little hammer or something light to pound with.

Cheap soldering iron, an electric iron which heats well is preferred.

Pair of pliers.

A small piece of high tin solder wire. Ordinary 50-50 (half tin and half lead) will be satisfactory though 60-40 or even 65-35 (65% tin and 35% lead) if obtainable locally is even stronger and will sweat better into the joints.

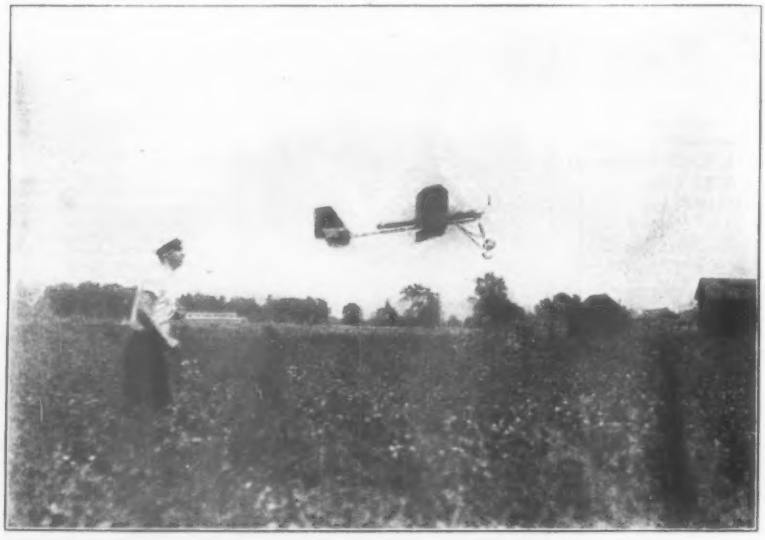
The parts for the Hoosier Whirlwind motor may be obtained from a number of model airplane supply houses or your local dealers. If your local dealer does not carry them you will find them advertised both assembled and disassembled in the advertising section of AERONAUTICS.

The set of parts will consist of:

3 cylinders.
3 cylinder heads.
3 pistons.
3 piston pins.
3 piston pin bearings.
3 connecting rods.
3 wrist pins.
3 air feeder pipes.
1 frame.
1 special valve housing and bearing.
1 valve cover.
1 air connection tube.
1 ready timed tough steel crankshaft.
1 counter ballance.
1 crank throw pin.
1 No. 6-32 light weight nut.
1 No. 4-36 light weight nut.
1 No. 6 washer and several small crank throw washers.

This list sounds like a lot of mate-

LAUNCHING A MODEL
Tudor Morris, holder of Hydro Record, launching his compressed air model



New Low Wing Monoplane

for Silver Ace Flying

F-21 LOW WING MODEL
Wing Span 25 inches Weight 3 oz.
Price, Ready to Fly, $7.00

THE entire fuselage of this fascinating new flying model is made of strong celluloid, beautiful in detail and color. Like all DeLuxe Silver Ace ships, it has a semiflexible propeller, detachable motor stick, shock absorbing landing gear, and silk covered demountable wings. In design and performance it will thrill you.

Send 10c for Silver Ace Illustrated Catalog with History of Flight

Describes and Pictures 18 Silver Ace models and construction sets. The most lifelike, longest-flying and most economical models produced by modern engineers. Light enough to give by far the lowest average cost per flight of any models you can buy or build. All first class dealers can supply you. If your dealer does not carry the Silver Ace line, remit to us, adding 50c for packing and shipping.

Silver Ace DeLuxe Cabin Type

Beautiful Fairchild or Stinson type, easily converted by demountable wings and pontoons into a biplane or seaplane. The best flying commercial model on the market.

Ready to fly monoplane	$12.50
Partly assembled	9.00
Knocked down	7.00
Extra wings, per pair	3.50
Pontoons, per pair	4.00

Silver Ace Tri-Motor Fokker

Designed to fly several hundred feet by power of central motor. Convertible into model of transatlantic "Friendship" by addition of pontoons.

Ready to fly monoplane	$25.00
Partly assembled	15.00
Construction set	9.00
Pair of Pontoons	4.00

Silver Ace Junior Racer

Convertible high or low wing monoplane or biplane. Automatic angle of incidence. A fascinating experimental flying model, capable of several hundred feet of flight.
Ready to fly (both wings included) $2.75

Silver Ace Sail-Plane

One of the latest Silver Ace models with demountable tapered wings and celluloid fuselage. Superlative in performance and appearance.
Ready to fly $1.50

Aero Model Company

DEPT. P9

111 North Wacker Drive, CHICAGO, ILLINOIS

rial. It is a lot of material but the amount of metal has been cut down so much that it is almost impossible to construct this motor from these parts and have it weigh over an ounce even though you are an amateur at soldering and literally use "gobs" of it. In fact, if an extremely small amount of solder is carefully applied the weight is around three-quarters of an ounce.

Some of the parts will come ready assembled, especially those that will require any special tools for this work. However, the Model Editor does not know exactly which parts will come partly assembled. Consequently, the method of assembling the motor completely from the individual parts will be described so that you can do every operation without any difficulty.

Study the drawing very carefully as it explains most of the details of alignment and the description will have to do chiefly with the little pointers and helps which have come up in the Model Editor's own experience with constructing several of these engines so that the Model Editor could tell the readers of the Model Section exactly how it is done.

First examine the crankshaft very carefully and study its operation by fitting it into the valve housing and rotating it slowly. The crankshaft has two special rotary valve slots, spaced, shaped and timed for the greatest efficiency and power. The narrower or rear slot is the intake and the front flat valve slot is the exhaust.

One end of the crankshaft has a flattened end so that the counter balance can be attached accurately at the correct timing. This should be fitted in place so that the crank pin is nearest the intake slot and the crankshaft. Solder the counter balance to the crankshaft. Carefully solder the crank pin into the little hole in the counter balance. Be careful not to rivet either of these parts in place as you may damage the threads on the ends of the crankshaft and the crank pin. The direction of rotation of the crankshaft is for a standard right handed propeller so keep this is mind in attaching the counter balance.

Assemble the special valve cover to the special valve housing and bearing. Very carefully remove any small burrs which you may find with the fine tooth file. Be sure that the air chamber fits up against the locating flange. (See drawing.) If a good flux and solder are used a hot iron will flow the solder neatly and quickly, making a good joint. The hole in the equalizing chamber should be exactly one-half way between two of the holes in the valve housing and bearing.

Next solder the little air connection tube into the hole in the valve cover. In order to give this little air connection tube sufficient strength the solder should be pooled up fairly heavily where it enters the valve cover. There is a small shoulder on the air connection tube which permits the tube to enter into the hole in the valve cover only a short distance. The little tube should be held in place until the liquid solder solidifies so that the pipe will be perpendicular to the center line of the housing.

Next solder the light frame to the center end of the valving housing and bearing. The hole in the center of the frame fits snugly over the end of the housing and bearing. Be careful in soldering this frame to the bearing that you do not get any solder on the end or inside of the bearing as this will interfere with the smooth operation of the crankshaft. The frame arms should be exactly in line with the rows of holes in the bearing. This can be aligned very easily and quickly by sighting straight down one of the frame arms toward the valve housing and bearing and turning the housing until the center of the one-eighth inch holes appears to be exactly over the center of the bearing. Be sure that the arms extend out true from the housing like the spokes of a straight wheel. The little bends in the ends of the frame arms should extend to the rear of the motor to hold the cylinders.

Solder the cylinder heads to each of the cylinders being careful not to use much force on the cylinders as the walls of the cylinders are thin enough that they can be bent by undue straining or by squeezing with pliers, etc.

This is all simple and easy especially if you have used a hot iron. You can do the work in less time than it took to read about how to do it. If the pistons are not furnished assembled they should be assembled next.

First slip the little wrist pins part way through the piston bosses and then slip the small end of the connecting rods into the slot in the piston pin boss. Line up the hole in the connecting rod with the hole in the piston pin boss and push the wrist pin the rest of the way through. Then spread the end of the hollow wrist pin.

A piece of one-quarter inch diameter rod cut off squarely at the end with a hacksaw slot through the center about one-half inch long makes a fine tool for holding the piston pin bosses while you slip the piston in place and rivet or center punch it tightly into the head of the piston. Do this very carefully so that you do not damage the corners or edges on the piston or knock the piston out of round. All three piston assemblies are identical. Even the minutest uncontrollable variation in manufacture may throw them a shade off so try each piston into each cylinder until you find the combination into which the pistons work easiest in the cylinders without undue drag or friction.

Carefully slip the cylinder heads in place. With a conical pointed stick placed in the open end of the cylinder, flow the solder into the joint while you rotate the cylinder with the stick.

Carefully tin the rear faces of the four prongs on the outer extremity of each frame arm. These prongs form a cradle for the cylinders. The cylinder heads should just fit against the outer ends of the frame arms as they locate the cylinders properly giving the pistons the desired cylinder head clearance. Now carefully attach the cylinders to the frame by flowing just a little solder under each one of the four prongs on each cylinder. A small drop of flux will help the flow of the solder in this operation as well as in any of the other soldering operations on this motor.

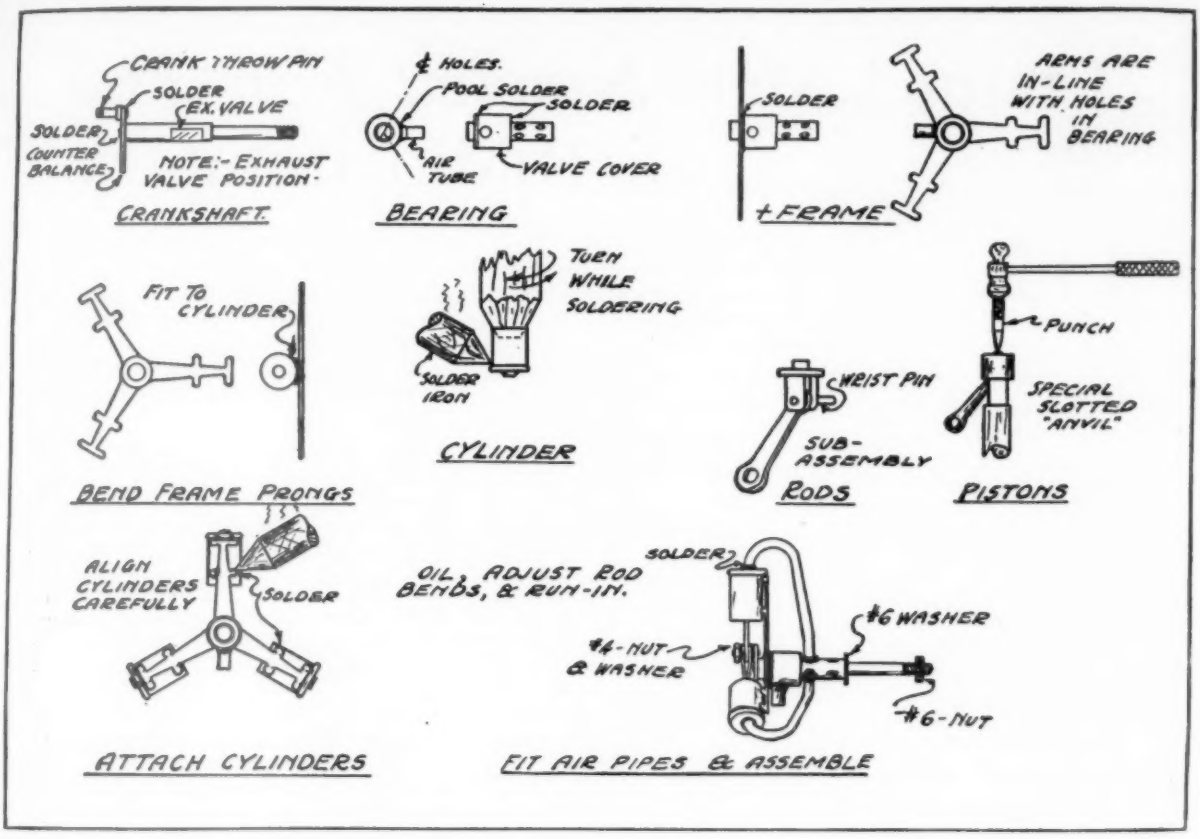
Before the next operation carefully align the cylinders. The center line of the cylinders should be at right angles to the center line of the crankshaft; and when the assembly of the bearing, frame and cylinders is rotated on the crankshaft the cylinders should be straightened if necessary so that they appear in line with each other, otherwise they will appear like the spokes of a wobbly wheel.

Next cut and fit the curved air feeder pipes so that they just fit inside of the raised holes in the cylinder head and at the same time just barely enter the nearest hole in the bearing. If the cylinders are lined up properly these air pipes should fit any cylinder. However, to save any worries or difficulties, mark each air pipe so that it can go back in the same place.

Carefully solder the pipes in place. Be careful not to spring the frame arm out of its true position. In this operation be sure to run solder all around the pipe where it enters the cylinder head. A hot iron and a little extra flux should do the trick.

Warning: The heat from the iron is very likely to loosen all the good soldering work you did on the cylinder and it may come unsoldered from the frame. To prevent this keep a wet rag stuffed up in the cylinder and use a sharp pointed hot iron which you can use part way around under the bend of the tubing. Also just touch the soldering iron to the work at intervals rather than hold it in place. In these ways you can prevent the other nearby soldered joints from loosening up.

At the inner end of the pipes you should build up a little extra solder around the pipes to give the joint extra strength. By doing this you will give the whole motor an extra stiffness and strength that is surprising. Do not use too much flux in attaching the inner ends of the pipes to the bearing as this might cause the solder to flow into the inside of the hole for the crankshaft.



Now that the frame is completely assembled the work should be given a thorough cleaning and inspection. If everything is found to be okay it should be oiled with special compressed air motor oil obtainable from the distributors of the Hoosier Whirlwind motor.

Now assemble the working parts. Slip the crankshaft in place and revolve it until it works freely using plenty of the special compressed air motor oil. Rotate the crankshaft until the counter balance is out of the way of one of the cylinders and slip the piston assembly in place. Very carefully slip the large end of the connecting rod over the crank throw pin. Do the same with the other two piston assemblies. You may find that the connecting rods are rather difficult to slip over the crank throw pin but do not remove any metal from the connecting rods as they should fit very snugly to the crank throw pin. A means of taking up the connecting rods on this little motor as on the big Whirlwind airplane engines is about the only thing this little motor has not been provided with! If everything is lined up as it should be, the center connecting rod should be straight and in line with the cylinder and piston while the first and last connecting rods slipped on the crank throw pin should be bent very slightly to offset their thickness. Slip a washer or two in place on the crank throw pin and screw the No. 4-36 nut snugly in place. Be careful in doing this that you do not cause any damage with the pliers. To tighten up this nut it is best to hold the counter balance to prevent the crankshaft from rotating.

Slip a No. 6 washer over the front end of the crankshaft. The shoulder on the shaft should be just slightly longer than the bearing so that this No. 6 washer will prevent the crankshaft from moving to the rear when the propeller is in place. For testing the motor, drill a hole a little larger than the crankshaft in a small block of wood or slip a piece of small tubing over the shaft so that you can force the No. 6 washer tightly in position by screwing down the No. 6-32 nut against the front end of the tube.

Oil all of the working parts of the motor again with the special air motor oil and run it in for about 3 to 5 minutes on an air hose or by attaching it to a pump. A suitable temporary air connection can be made by soldering a one-eighth inch outside diameter brass tube several inches long onto a standard bicycle or automobile tire valve stem. Remove the valve core from the valve stem. The one-eighth inch pipe should just fit inside of the short air connection pipe on the air equalizing chamber on the motor.

When the motor runs freely you should attach it to the tank using three pieces of thin brass or bronze about five thirty-seconds to three-sixteenths inch wide. These should extend straight to the rear from the cylinder heads. About three-sixteenth inch at the rear ends should be bent up to lie flat against the surface of the tank cap. Solder the motor in place on the tank being careful to watch the following two points:

1. See that the center line is lined up as closely as possible to the center line of the tank.

2. Also see that the air connector tube of the motor is in line with the air connector tube on the throttle valve.

Bend and fit a piece of one-eighth inch tube so that it connects the throttle valve with the air feeder tube on the motor. Carefully flow solder all around the junctions at the end of this pipe being careful not to loosen other soldered connections near by.

The motor and tank unit is now ready to install in the model.

The last, and final installment, appearing in the October issue of Aeronautics will deal with the carving of the propeller, the assembly of the various parts and give complete instructions for flying the compressed air model.

Trained Men *Needed For The* Radio Industry

An Editorial
By C. A. Darling, Editor
RADIO MANUFACTURERS' MONTHLY

DURING the last few years the radio industry has grown with such incredible speed and to such an enormous size that today there is a serious shortage of men with sufficient technical and practical knowledge to install properly and to service intelligently the millions of radio receivers.

There are at present, according to estimates, between 10,000,000 and 12,000,000 radio receiving sets in use in this country, which necessarily require thousands of men to keep them in correct adjustment and operating condition. Last year alone, radio manufacturers produced $650,000,000.00 worth of new equipment.

Modern receiving sets are becoming more and more complete electrically, consisting of from five to ten tubes or more, with the accompanying coils, transformers, condensers and circuits. In addition there are complete electric power supply units consisting of transformers, tubes and filters. Also loud-speakers are incessantly developed that are marvels of electrical and mechanical construction.

Such equipment as this is no longer a device to be tinkered with by anyone who happens to have the inclination, and who claims a knowledge of all radio because he has built a set or two.

Instead, with the compact construction, complex circuits and delicate parts and adjustments of the new radio receivers, they should be intelligently cared for, inspected and serviced by thoroughly trained men who have a complete knowledge of electricity in general and of radio in particular. These men should know definite and systematic tests to make with proper equipment to locate and correct any trouble and make proper adjustments, without ruining some part of the set with which they are unfamiliar.

Such knowledge and ability cannot be merely "picked up" and kept up to the rate of progress of the radio industry with its ceaseless refinements and developments. It can, however, be obtained in proper institutions of learning, where both the fundamental theory and the very necessary practice can be obtained under competent instructors and with proper equipment.

There are a number of such institutions open to the ambitious man who wants to qualify for the great opportunities in this field. Some of our better high schools and our colleges are offering courses in this work. Some of the radio manufacturers are finding it necessary to supply special training along these lines to qualify their own employees, so difficult is it to obtain trained men.

Schools devoted to the practical instruction of electricity do fine work in providing thoroughly efficient courses of radio training. Some of the schools are completely equipped with every necessary facility, and in many cases original methods are used in carrying on the work.

In these schools one sees hundreds of ambitious young men busy in the various departments, working on electrical machinery of all kinds, thoroughly proving out the principles and applications of general electricity. In one section an interested group receives personal instruction from an instructor who illustrates certain principles of electricity and radio, first on a blackboard, then by demonstration on actual equipment. A little later this group goes into the shop section and works out the complete job with the help and guidance of experienced instructors on the various steps.

In another department advanced students build complete receiving sets of various types. Others make various tests and adjustments, and receive definite instruction on systematic methods of "trouble shooting," or fault location on the finished sets.

In still another room a group views a special motion picture film that shows in a clear manner the inner workings of vacuum tubes and radio devices and circuits in general. Fundamental transmitting station circuits, equipment, principles and operation are explained, *as is also the application of radio to aviation.*

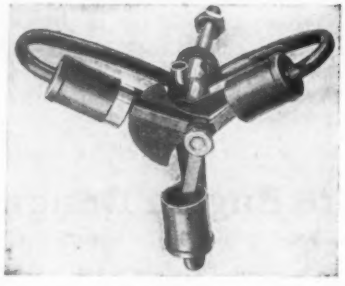
In fact the entire ground is covered. These courses are invaluable to the young man who desires to make radio his work, and who has not the opportunity for technical institutes, or for instruction in any of the electrical engineering schools in the universities. The need for practically trained men in the Radio Industry is great.

This editorial is published and paid for in the interest of the Radio Industry by Radio Manufacturers' Monthly, a publication circulating to every Radio Manufacturing Executive in the United States and Canada.

If you are interested in training yourself for this important and growing industry, a letter to the address below will bring you interesting information without obligation.

RADIO MANUFACTURERS' MONTHLY
McGRAW-HILL BLDG. 520 North Michigan Ave. CHICAGO, ILLINOIS

LOOK!



HOOSIER WHIRLWIND COMPRESSED AIR MOTOR. Weight ⅞ of one ounce, counter balanced steel crankshaft, a regular three cylinder radial motor. Only 3" dia. Flies 4½ ft. to 6 ft. models. Finished parts, easy to assemble, $2.90 postpaid. Completely assembled and tested $4.90 postpaid.

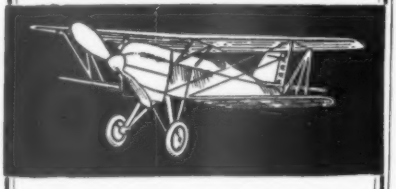
COMPRESSED AIR TANK.—Materials for 3" x 2½" tapered tank 24" long, $3.50 postpaid.

COMPLETE KIT FOR 4½ FT. COMPRESSED AIR MODEL with blueprint less tank and motor $4.00 postpaid. Have an air model for your next National Model Airplane contest. Order today! Be sure and inclose only money orders or drafts.

SEND 10c AT ONCE FOR A NEW ILLUSTRATED LIST JUST OFF THE PRESS showing all the latest and best materials as used by recent National contest winners of trips to Europe, etc., with surprising low prices on the best materials. **Schools, clubs, dealers write for terms. "Model Airplane Experts of Today are the Aviation Experts of Tomorrow."**

PERU MODEL AIRPLANE SHOP
Peru, Indiana

2-FOOT CURTISS HAWK



This model has flown over 300 feet. Complete construction set with plan.....**$2.50**
Blue prints alone.....**$0.25**

2-FOOT FOKKER UNIVERSAL
has flown over 500 feet. Complete construction set with plan.....**$2.00**

OUTDOOR TWIN PUSHER
Complete kit with plan.....**$2.00**
Endurance Baby R. O. G. Kit.....**$0.50**

Booklet 5c., credited on 1st order.

HAWTHORNE MODEL AERO. CO.
Dept. C **Hawthorne, N. J.**

Simplex Air Model Co.
AUBURN, MASS.

Send 5 cents for complete parts list. A 5 cent service charge is required on all orders amounting to less than $1. A 5 cent packing charge is required on all shipments of wood or metal greater than 18" in length. Prices are subject to change without notice. All goods sent postpaid in the U. S. A. No stamps or C. O. D. orders accepted.

	Spruce	Balsa
1/16" x 1/16" x 3'	.03	
1/16" x 1" x 3'		.06
1/8" x 1/16" x 3'	.03	.033
1/8" x 1/4" x 3'	.045	.054
1/4" x 1/4" x 3'	.054	.06
1/2" x 1" x 3'		.24
1" x 2" x 3'		.48
1" x 3" x 3/16"		.56

Reed 6' lengths. 1/16" diam. .05c; 1/8" .075c; 3/16" .10c; Balsa discs 1/4" thick 2" diam. .07c; 3" .08c; 4" .09c.

Ambroid dope, ¼ pint .50; ½ pint..... .95
Ambroid cement, 2 oz. .33; 4 oz..... .53
Bamboo paper 13x30" .12; 24½" x33⅜"..... .14
Rice paper, 18" x24, .09; 21" x25"..... .06
Wood veneer, 20" x30"..... .22
Flat rubber 50' of 1/8", .50; 50' of 3/16"..... .75
Piano wire 3' of No. 5 or No. 8, .04; 3' of No. 11 or 15..... .06
28-30-32-34 steel wire, per spool..... .10
1/16" copper washers, 10 for..... .05

We can supply any size balsa that you need, also propellers, I beams, wing sections, bolts, nuts, screws, brads, aluminum, brass tubing, turnbuckles and books on model building.

Naval Flight Test Procedure

(Continued from page 64)

reduced. The airspeed meter reading was recorded and, referring to the calibration curve, we obtain a corrected airspeed indicator reading. Knowing the standard altitude of the corresponding airspeed indicator reading, from available curves, we obtain the proper $\sqrt{\frac{P_o}{P}}$ value and this applied to the corrected airspeed indicator reading gives the true airspeed of the plane at the altitude in question. True airspeeds during the climb are obtained in the same manner.

We now have sufficient data to construct the following curves which represent all that are customarily included in a Flight Test Report: Airspeed Indicator Calibration; Altitude versus Time; Rate of Climb versus Altitude; Speeds During Climb versus Altitude; Maximum Speeds versus Altitude; Climbing R.P.M. versus Altitude; and Maximum R.P.M. versus Altitudes. At times data on fuel consumption are obtained but results obtained have been so inconsistent and of doubtful service value that for the present this practice has been abandoned. It is expected that when a satisfactory flowmeter is developed, valuable data on fuel consumption in flight and hence data on range and endurance will be obtainable.

This concludes the performance part of Flight Testing. Before the flight test unit is finished with the plane, however, it is routine to fire the guns, compensate the compass, obtain the antenna constant of the plane and test the radio in the air, as well as to accomplish any special tests required of a special type.

As experience has been gained with flight test work, certain conveniences have been developed which greatly aid the pilots and simplify the reduction of data. Printed cards are provided for the collection of data and printed forms facilitate their reduction. Figs. 7 to 11 show some in use by the Navy unit at Anacostia.

The establishment of flight test units has been of inestimable value to the Government and to the industry. It has succeeded in keeping the designers honest and added greatly to the store of knowledge concerning aerodynamics. No type of ship is now issued to the service until complete knowledge concerning its performance and flying qualities is known. The soundness of this policy is beyond argument.

No discussion of Flight Testing would be complete without some mention of the type of pilot required for this work.

A New IDEAL Model Airplane

The
"American Eagle"
Wing Span: 26 in. Weight: 3¾ oz.

Distinctive in design—new in construction—a light, durable, fast-flying model with IDEAL'S twenty years' experience behind it, and months of dependable performance before it! Wonderful stability in the air, and GUARANTEED to FLY when hand or ground launched. Many new construction features; motor can be wound with winder without removing from fuselage; indestructible landing gear; new type propeller. Construction Set is easy to build; also sold completely assembled.

Construction Set--$2.50 **Assembled Model--$5.00**

Sold by Toy, Sporting Goods and Department Stores. Ask for the IDEAL "American Eagle" Model. If unobtainable, order direct. West of Denver, prices are 50c higher.

64-Page Catalog of Models, Parts and Supplies for builders **5c**

IDEAL AEROPLANE & SUPPLY CO., Inc.
22-26 West 19th Street **New York City**

AVIATION BADGES
Sterling silver, silver-plated, rolled gold and embroidery

Transport **Pilot's Badge**

We are equipped to furnish all types of badges, both metal and embroidered.

Transport Pilot badge as illustrated can be furnished with the letters T. P. on the wings (representing transport pilot) with your license number above the shield.

Large Size		Miniature
$3.25	Licensed Transport Pilot's Badge, Gold Plated or Silver Plated	**$1.75**
$5.00	Licensed Transport Pilot's Badge, Rolled Gold or Sterling Silver	**$3.50**

Booklet sent on request

N. S. MEYER, Inc.,
43 East 19th St., New York

PATENT YOUR IDEAS
Send me a sketch or simple model of your invention. Satisfactory terms.

DO IT NOW

DO IT NOW

Write for your Copy

Save money on aviator's summer and winter clothing. Illustrated catalog mailed free upon request. **Write Dept. "A"**

BECKER'S
159-06 Jamaica Ave./ Jamaica, N. Y. C.

When you build model planes and gliders, use Balsa Wood

Commercial builders make their planes from Balsa Wood—it is the lightest wood known, yet weight for weight strong as pine. Its resiliency like that of spruce. We have Balsa Wood pieces cut in special sizes for the builder of model planes and gliders. Prices as below.

Prices Postpaid

Length	Width	Thickness	
36″	6″	2″	$1.25
36″	6″	3″	1.75
40″	5″	2″	1.25
40″	5″	3″	1.75
36″	6″	⅛″	.60

Prices on other sizes furnished on request

See us at the Cleveland Air Show, Booths 46 and 47 in the esplanade.

THE FLEISCHMANN TRANS. CO.

Balsa Sales Dept.

69 Bank Street
New York City

Chicago, Ill.
327 So. La Salle St.

San Francisco, Calif.
245 11th St.

Write for our free booklet on model construction

Popular conceptions would indicate that the fearless type of stunt pilot would be the most successful. Although this quality is no drawback, the nature of the work calls in a greater measure for the experienced, smooth, patient pilot equipped with an inquiring mind. He must be capable of flying anything, large or small, and must be at home in the air in order that he may pay attention to other things besides flying. He need not be a super pilot but he must be a good pilot. Next to the ability to feel comfortable in any type of plane in the air, the most valuable asset for the successful test pilot is patience.

Possibilities in Future Engine Design

(Continued from page 25)

stress demands for structural reasons, such as resistance to piston side thrust, and is therefore the same for all diameters.

An aeronautic motor must be compact enough to lend itself easily to the slender streamline body of the airplane. This, of course, is impossible with the type of engine now in extensive use both because of the great overall diameter and because it is impossible to cowl in aircooled cylinders and cool them at the same time. Cylinders have been individually faired, but this is possible only with the fastest machines without impairing the proper functioning of the cooling system.

A new method of cowling radial aircooled engines, recently developed by the N.A.C.A. will reduce the wind resistance of this type of engine 50 per cent, it is claimed.

No less than three theoretical explanations have been given as to the principle underlying the operation of the cowling, but the most logical seems to be the following:

The cowl acts very much in the same way as the slotted auxiliary airfoil. It changes the direction of air flow over the nose of the fuselage, bending the flow inwards toward the center of the body just aft of the engine cylinders and causing the air to follow the contour of the fuselage very closely all the way to the tail. The action in this case is analogous to the prevention of burbling in an airfoil by the opening of the leading edge slot, it being assumed that the cylinders cause a discontinuity in the surface of the fuselage, which causes burbling, or departure of the streamlines from the surface, as can be seen from Fig. 1.

Despite many arguments to the contrary, however, the wind resistance of the aircooled power plant is considerably greater than that of the watercooled type. For instance, the British entries for the Schneider Cup Race at Venice, Italy, in 1927 included three types of engines: geared and direct drive Napier Lions, and a Bristol "Mercury" aircooled radial engine. All of these engines developed about the same horsepower, but the weight of the "Crusader," as it was called, in which the aircooled plant was installed, was several hundred pounds less than that of the watercooled racers. This great saving in weight permitted the use of a smaller wing area and of a generally lighter structure throughout. Despite the weight handicap, however, the watercooled racers were fifty miles per hour faster.

The reason for this is quite obvious. The watercooled engines were completely cowled in, and their radiators, which were built into the wings, followed the contour exactly. In other words, the total power plant drag was almost zero. The aircooled engine, on the other hand, although it required no radiator, could not be completely cowled due to the necessity for the entrance and exit of the cooling air.

Due, therefore, to the disadvantages of the radial engine as regards wind resistance, in-line aircooled engines are becoming popular, especially for light machines, and it has been found that where this type has been substituted for a radial, increased performance resulted.

As far as cooling is concerned, all engines are fundamentally aircooled. In so-called watercooled engines, the cylinder heat is simply absorbed by water which is circulated through jackets placed around the cylinders, being in turn cooled by passing through a radiator. It is obvious, therefore, that by varying the area of the radiator or the speed of the water through the plumbing system, the running temperature of an engine can be controlled within definite limits. The control of the running temperature of the aircooled engine is limited by the amount of cooling fin area that can be accommodated on the cylinder itself. Therefore, it is possible to obtain much greater power outputs from watercooled engines. However, increasing the compression ratio of the watercooled engine results in greater heat being produced, with consequent need for a larger radiator, so that the total performance of the airplane is not increased appreciably. As the radiator is the main source of power plant resistance in watercooled installations, any reduction in its size is bound

to be accompanied by an increase in the total performance of the craft.

Since the heat absorbed by the air from an object is proportional to the difference in temperature between the air and the object under consideration, it is obvious that if the water outlet temperature could be increased beyond what is now common practice, the heat would be dissipated faster, although the total amount to be dissipated would be the same in both cases, and hence the size of the radiator could be reduced. However, as far as using water as a cooling medium, its boiling point of 212 deg. Fahr. immediately bids us hold our peace.

Internal combustion engineers, therefore, have been striving to find a cooling medium with a higher boiling point than water to allow the engine to operate at a higher thermal efficiency. Many different liquids such as mineral oil, kerosene, salt solutions, glycerine, and other compounds have been tried, but all have failed. Some are inflammable, some have no definite boiling point, and divide up into volatile fractions when heated, while others corrode the metal engine parts with which they come in contact and deteriorate the rubber hose connections in the cooling system. Other liquids, in addition to the disadvantages stated, have a low specific heat.

The engineers of the Power Plant Branch of the Material Division, U. S. Army Air Corps, however, have recently developed in the laboratory at Wright Field an almost ideal method of cooling watercooled types of engines. This development has been the result of a number of years' intensive research which has culminated in the successful operation of the system.

The liquid used in the system is known as "ethylene glycol" and is one of the simplest of the polyhydric alcohols, having the chemical formula $CH_2OH.CH_2OH$. This liquid has a boiling point of 388 deg. F., and has all of the properties required of a cooling liquid, namely, relatively high specific heat (slightly lower than that of water), excellent wetting qualities, and non-corrosive of metals. It is manufactured on a commercial scale and is comparatively cheap. It is being used extensively by the automotive industry, mixed with water, as an anti-freeze preparation. Since it has been known for fifty years, it is by no means a newly discovered liquid, although its use with high temperature internal combustion engine cooling is a new development.

Since ethylene glycol has a boiling point of 388 deg. F., it permits operating the engine at a higher temperature than was before possible. The temperature found most suitable to operate the engine is 300 deg. F. This temperature gives an amply safe margin below the boiling point of the liquid.

In order to allow the cooling liquid to maintain an outlet temperature of 300 deg. F., it must either be pumped through the engine at about half the speed of the water otherwise used, or at the same speed, but in about one-half the quantity. The latter method has been found more practical, as the size of the piping and the weight of the liquid are thus reduced. This alone would cut the radiator size one-half. However, since the fluid is at approximately twice the temperature of the usual water, the radiator size is again reduced by one-half, so that as compared with the watercooled power plant of the same power, the radiator size on an ethylene-glycol cooled power plant is reduced 75 per cent.

The above analysis points out several startling facts, and is the basis for my arguments concerning what the future holds in the field of aircraft engine design.

In the first place, it would seem to indicate, would it not, that the at present predominating type of the engine, the aircooled radial, will soon have fulfilled its period of usefulness. It has proved invaluable in the development of aviation, but it must pass.

With regard only to structural details now, the ultimate aviation engine will no doubt be of the inverted in-line type, with its single bank of cylinders hanging below the crankcase. The inverted engine has the following important advantages:

(1) It lowers the center of gravity of the machine,

(2) The engine is readily accessible to a mechanic working on the ground,

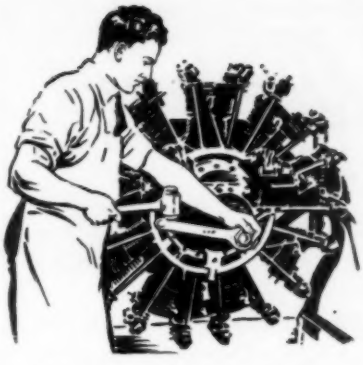
(3) It permits practically unimpaired visibility for the pilot,

(4) Its high center of thrust insures better flying qualities by offsetting a tendency of the ship to climb when full power is suddenly thrown on,

(5) It allows a larger gravity head for fuel flow from the tank to the engine, and

(6) Since, in order that the ship tends to dive and increase its speed when the engine is throttled, there must be a negative pressure on the tail surfaces, the center of thrust must be as high as possible, which requirement the inverted engine meets ideally.

(The final part of Mr. Meyers' article, dealing with the Diesel engine as developed for the airplane will be published in the October number of Aeronautics. The Editor believes that Mr. Meyers' conclusions will be of interest, even to those who are not disposed to agree with him in every particular.)



Your Chance to Enter Aviation

THE FASTEST-GROWING FIELD of opportunity in the world today is in the business of flying. The planes that hum overhead are but forerunners of great fleets of aircraft that will fill the skies and the landing fields of the future.

Careers and fortunes will be made in aviation in the next ten years—made by men who learn it "from the ground up"—as mechanics. It is engines that are making aviation—engines and men who understand them.

The new International Correspondence Schools course in Aviation Engines offers *you* a real, practical opportunity to get into aviation. It is complete, up to date, easy to understand. Every lesson in the course has been prepared by an expert, fitted by training and experience to give you a thorough knowledge of the subject. Many of the lessons are written by Lieutenant Commander Donald M. Carpenter, U. S. N., formerly in charge of all theoretical and practical ground training of student aviators at the Naval Air Station, Pensacola, Florida.

This course not only gives you a complete understanding of engine theory and principle, but an accurate working knowledge of every modern type of aviation engine—its carburetion, ignition, lubrication, timing, cooling, as well as accessories, up-keep and repair.

Studying with the I. C. S. you do not need to save up a large sum to tide you over. You don't need to give up your present job. You can learn, *while you earn*, studying in your spare time, at home. And you can start *now*. It costs nothing to find out all about the I. C. S. course in Aviation Engines, or any other course that interests you. Just mark and mail the coupon below. Do it today!

INTERNATIONAL CORRESPONDENCE SCHOOLS
"The Universal University"
Box 5841, Scranton, Penna.

Without cost or obligation on my part, tell me how I can qualify for the position or in the subject *before* which I have marked an X.

☐ AVIATION ENGINES

☐ Complete Automobile Course
☐ Automobile Electric Equipment
☐ Electrical Engineering
☐ Electric Lighting
☐ Mechanical Engineer
☐ Mechanical Draftsman
☐ Machine Shop Practice
☐ Railroad Positions
☐ Civil Engineer ☐ Mining
☐ Surveying and Mapping
☐ Plumbing and Heating
☐ Steam Engineering
☐ Gas Engine Operating
☐ Complete Gas Engine Course
☐ Architect
☐ Architects' Blueprints
☐ Contractor and Builder
☐ Architectural Draftsman
☐ Concrete Builder
☐ Structural Engineer
☐ Pharmacy
☐ Chemistry
☐ Agriculture
☐ Navigation
☐ Mathematics ☐ Radio

BUSINESS TRAINING COURSES

☐ Business Management
☐ Industrial Management
☐ Personnel Management
☐ Traffic Management
☐ Accounting and C.P.A. Coaching
☐ Cost Accounting
☐ Bookkeeping
☐ Secretarial Work
☐ Salesmanship
☐ Spanish ☐ French
☐ Advertising
☐ Business Correspondence
☐ Show Card and Sign Lettering
☐ Stenography and Typing
☐ English ☐ Civil Service
☐ Railway Mail Clerk
☐ Common School Subjects
☐ High School Subjects
☐ Illustrating
☐ Cartooning

Name.....
Street Address.....
City..... State.....
Occupation.....

If you reside in Canada, send this coupon to the International Correspondence Schools Canadian, Ltd., Montreal

INVESTIGATE THIS OPPORTUNITY

Airplane Drafting and Designing is the biggest job in the biggest industry of modern times. A new field of opportunity has been opened up by our improved method of training.

STUDY AT HOME
EASY TO LEARN
PAY AS YOU GO
EMPLOYMENT SERVICE

Write for booklet outlining interesting courses in Airplane Drafting, Aviation, Airport Management, Weems System of Navigation—endorsed by Colonel Lindbergh, Commander Dick Byrd, Lincoln Ellsworth, Admiral Moffett and others.

Pacific Technical University
Dept. A
San Diego California

Examination and rating by U. S. Department of Commerce applied for.

Without obligation, please send me further information about your *Airplane Drafting Course*

Name _____

Address _____

City _____ State _____

2119 KETTNER BLVD.

Monthly Financial Review

(Continued from page 75)

	Number of Shares of the New Holding Company which Will Be Exchanged for Each Share of the Old Company Stock	
	Class A Stock	*Common Stock*
Curtiss Aeroplane & Motor Company, Inc.	One	Four and one-half
Curtiss Airports Corporation	.....	Five-twelfths
Curtiss Flying Service, Inc.	.....	Five-sixths
Curtiss Aeroplane Export Corporation	.....	One and three-tenths
Curtiss-Caproni Corporation	.....	Five-twelfths
Curtiss-Robertson Airplane Manufacturing Company *	.....	Two
Wright Aeronautical Corporation **	One	Three and one-quarter
Keystone Aircraft Corporation	One-half	One
Moth Aircraft Corporation Unit †	.....	One
New York and Suburban Air Lines, Inc.	.....	Two-fifths
New York Air Terminals, Inc.	.....	One

* The right of exchange under the Plan belongs only to holders of common stock of Curtiss-Robertson Airplane Manufacturing Company.

** If the plan is declared effective, the holders of stock in Wright Aeronautical Corporation who become parties to the Plan will then be entitled upon exchanging their certificates of deposit for stock of Curtiss-Wright Corporation to an option warrant entitling each such holder, for a period of three (3) years from the date when the Plan is declared effective, to purchase one share of the Common stock of Curtiss-Wright Corporation at Thirty ($30.00) Dollars a share for every two (2) shares of Wright Aeronautical Corporation formerly held by such stockholder.

† The unit referred to consists of one share of Class A stock and a half share of Class B stock of the Moth Aircraft Corporation, and the offer relates to the unit as such and no rights are granted to holders of Class A or Class B stock, as such.

tion, it does not seem possible for any hitch to occur in the plans for the new holding company, and, as a matter of fact, the Directors of several of the companies have already met and formally recommended the exchange to their stockholders.

This merger is viewed with considerable sentiment by persons who have been following the progress of the aeronautical industry for the past decade. It brings together two pioneer companies in American aviation, in addition to a group of smaller units which have grown up around them. The stocks of the various units going to make up the merger are still being traded in on their various Exchanges, but the fact that the stock of the holding company is also being traded in on the New York Curb Exchange naturally robs them of some of their former interest.

Thus we have in this consolidation another striking piece of evidence of the healthy trend in the aviation industry. Not only are numerous smaller units consolidating for their mutual benefit, but even the largest and most successful are following the same plan, which, if pursued to its logical limits, will be a stabilizing factor of the utmost importance to the aviation industry as it approaches the period of its severest test.

Shortly before the announcement of the Curtiss-Wright Corporation merger, it was stated that C. M. Keys, head of the Curtiss-Keys group, and interests closely identified to himself had purchased the entire capital stock of Pitcairn Aviation, Inc. This company operates a route covering 1,520 miles in daily operation and holds the U. S. Government air mail contracts between New York and Miami via the chief centers of population on the South Atlantic Coast. It has since been reported that Pitcairn Aviation, Inc., acquired by C. M. Keys and associates, was sold by them to North American Aviation, Inc., an investment trust and holding company closely identified with the Curtiss-Keys group, which already owns the Sperry Gyroscope Company.

Stinson Aircraft Corporation has announced that plans are being worked out to merge that company with the Wayne Tool and Manufacturing Company of Detroit. When negotiations are completed it is understood that a public stock offering will be made of shares in the new holding company.

Bendix Aviation Corporation has announced that it has purchased outright for cash all patents and claims pertaining to the Stinson brake control mechanism, which should be a valuable advantage to its already long list of aircraft accessories.

United Aircraft & Transport Corporation has made an offer to purchase the outstanding Class A and Class B stock of the Pacific Air Transport Company, which they already control. The offer is to exchange 3 shares of United Aircraft Stock for each share of Class A

or Class B stock of the subsidiary company.

Allied Motor Industries, Inc., which controls the Great Lakes Aircraft Corporation, has acquired an option, good until August 15, 1929, to purchase a controlling interest in the American Cirrus Engines, Inc. If the deal is consummated, the stockholders of the former company will be offered "rights" to acquire stock of the latter company in proportion to their present holdings in the former company.

The Pioneer Instrument Company has sold control to the Bendix Aviation Corporation. This company is one of the foremost manufacturers of aeronautical navigating instruments in the country, and its products have a fine reputation among the numerous manufacturing units which use these instruments exclusively.

Sikorsby Aviation Corporation has been acquired by the United Aircraft & Transport Corporation. This confirms rumors which have been abroad for several weeks that a deal was in the process of consummation. The addition of the foremost American manufacturer of amphibians adds another important company to the already formidable array of units which go to make up the United Aircraft & Transport Corporation.

Miscellaneous Financial Items

Aviation Corporation on May 31st reported that, in its first four months of operation, the company had an earned surplus of approximately $600,000, with cash and call loans equal to approximately $24,775,000 in addition to $6,000,000 in marketable securities. During the remainder of the year, when the effect of consolidating the various subsidiaries under one central management has been carried further, it is predicted that the corporation will be able to show somewhat in excess of $1 a share earnings on the common stock now outstanding. An example of what can be accomplished by unified management, such as is afforded the companies which go to make up the Aviation Corporation, is well illustrated in the case of the Fairchild Aviation Corporation. This company reported a net loss in 1928 of $95,318, and in the first quarter of 1929 the same company shows a net profit of $28,881.

Stearman Aircraft Company has authorized an increase in capital stock of the company from 20,000 shares to 100,000 shares. Stockholders will receive 5 shares of the new stock for each old share held.

Walter T. Varney has sold his interests in the Pasco-Salt Lake air mail line to interests identified with the Aviation Corporation of California and a new company called the Varney Airlines, Inc., has taken over the physical assets formerly owned by Mr. Varney.

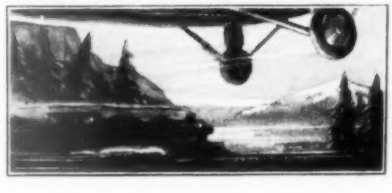
United Aircraft & Transport Corporation reports for the five months ending May 31, 1929, a net income of $3,327,414, equivalent, after preferred dividend requirements, to $1.75 per share on the common stock. This compares with total earnings for the year 1928 of $2.52 per share on the common.

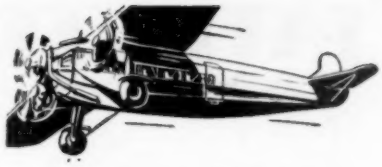
Thompson Products, Inc. For the first five months ending May 31, 1929, earnings were $646,661, equivalent to $2.41 per share on the combined A and B stocks. This compares with $417,208, or $1.65 per share earned during the same period on both classes of stock in 1928.

Wright Aeronautical Corporation. This company reports that for the six months ending June 30, 1929, net income will be approximately $1,434,000, equal to $2.40 per share on the present common stock, against $1,092,000, or $3.64 per share on 300,000 shares which were outstanding in the first six months of 1928.

This statement is extremely important in that it is the first actual indication of a slowing down in the business of some aircraft manufacturers. Previous estimates of Wright Aeronautical Corporation earnings had been considerably higher and the decline is attributable to the inability of Wright customers to sell their products. Naturally, the motor company gauged its production by orders from manufacturers of aircraft and when these concerns could not sell their planes, orders with the Wright company for motors were cancelled or held up.

Another important item in the Wright statement is the profit realized from the sale of some Bendix Aviation Corp. stock, which amounted to $350,000. If this is deducted from net income, it will be found that profit from operations in the second quarter came to only $550,000, or 91 cents a share, and for the half year equalled $1,084,000, or $1.81 a share. It does not seem that the revised prices which were put into effect last November nor the introduction of its new line of motors has helped the company. This is substantiated by the fact that a decrease in net income of almost $72,000 is shown in the second





Prepare for an

Aviation

Career. Get your necessary preliminary training now

The call is for men—*trained men*—who can take responsible positions in this rapidly growing industry and share in its certain future.

A new book, "Aviation—Its Opportunities for You"—sent free upon request — answers your questions about a career in aviation for you. Tells you how to get started; the salary you can hope to earn; how to get the necessary training to get the position and future you want.

This interesting book also tells you about a remarkable new method of Home Study Training that takes you from the very beginning of aviation and guides you right up to the point where your practical experience begins. Then, if you want to fly, arranges flying instructions at reduced rates. You receive the constant help and guidance of an Advisory Staff, composed of men in the manufacturing and maintenance and flying branches of the industry. As soon as you are ready, you receive the help of an Employment Service, without charge.

Mail Coupon for Aviation Book

Whether you intend to learn flying or prepare for one of the well-paid ground positions, you should send for a copy of "Aviation—Its Opportunities for You." It outlines a plan that has helped many ambitious men get started in the aviation industry. Sent free to those who write at once. Mail the coupon now.

Aviation Book Coupon

NATIONAL AVIATION TRAINING
Pioneer Home Study School in Aeronautics
Dept. 401, 1031 So. Broadway, Los Angeles, Cal.

Please send me free copy of "Aviation" pointing out my opportunities. Also details of your Home Study Course in Aviation.

Name..... Age.....

Address.....

City..... State.....

PATENTS

FREE BOOK

Contains valuable information relating to patent procedure. Address the nearest office below and a copy will be sent to you without charge or obligation.

Before too heavy an outlay of time or money is made on an invention, a Search of the Patent Office records should be made to determine as nearly as possible whether or not the same idea has before been Patented. The cost of this Search is small, while the value of the facts it uncovers is often considerable. We offer inventors, manufacturers and attorneys a thorough, prompt, confidential Search Service—plus experienced counsel and assistance in every phase of Patent and Trademark practice.

CLARENCE A. O'BRIEN
Registered Patent Attorney

3157 Security Savings and Commercial Bank Building, WASHINGTON, D. C. — OR — Suite 1108 Woolworth Building, NEW YORK CITY

MODEL FLYERS!

For better results order your models, kits, supplies and accessories from a reliable concern.

We only carry the best materials and our prices are the lowest.

SEND FOR OUR PRICE LIST AT ONCE!

Indoor Tractor	$0.85	Outdoor Twin Pusher	$3.00
Junkers Bremen	5.00	Morris Hydroplane	3.00
Stinson Detroiter	1.50	Curtiss Hawk	3.00
Baby R. O. G.	.75	"Cloudbreaker" R. O. G.	.75

BALSA

1/32" x 2" x 3'	12c	1/16" x 2" x 3'	12c
1/16" sq. x 3'	4c	1/8" x 1/2" x 3'	7c
1/8" x 1/4" x 3'	4c	3/8" x 1/2" x 3'	9c

Bearings, .025 Hole, or .035 Hole. Each 5c
Mino Silk Tissue, 21" x 31" 5c
Ambroid, 2 oz., 28c; 4 oz. 48c
Banana Oil, 2 oz. 18c
Wing Dope, 2 oz. 20c
Bamboo Varnish, 2 oz. 28c

Other supplies at the most reasonable prices!

INDEPENDENCE MODEL AIRPLANE CO.
Formerly Eagle Model Airplane Co.
INWOOD, L. I., NEW YORK

AVIATION
NEEDS
AIRCRAFT DRAFTSMEN!

New Correspondence Course Now Ready from the Old RECOGNIZED SCHOOL OF DRAFTING

Study at Home—Simple Methods—3 to 6 Months—Same Instruction as our Local Classes. Low Monthly Tuition—Free Employment Service.

Mail Coupon for Illustrated Book

Columbia School of Drafting & Engineering
(Nineteenth Year)
13th and E Sts., N. W. Washington, D. C.
"All Branches of Drafting"

Please send me without obligation your new catalogue on "Drafting and its opportunities."

Name _____

Address _____

City _____ State _____

quarter of 1929 compared with the corresponding period last year, although actual shipments of engines were 73 per cent greater.

North American Aviation, Inc. This company reports a total income for the first six months of 1929 of $1,436,306 and a net income of $1,172,080, after taxes. This equals 58 cents per share on the 2,000,000 shares of no par common stock outstanding at this time of writing.

Below are given the closing prices on various aeronautical stocks on the New York Stock Exchange and the New York Curb Exchange as of July 19th, with the high for the year and the previous month's closings also given for comparison:

	High 1929	Closing June 19, 1929	Current July 19, 1929
*Bendix Aviation Corp.	95	82⅝	93⅝
*Curtiss Aeroplane & Motor Co.	173½	159	165
*National Air Transport	48¼	37⅝	40¾
*United Aircraft & Transport	162	116⅝	136¼
*United Aircraft & Transport Pfd.	109½	80	89⅞
*Wright Aeronautical Corp.	149½	122	134¾
**Aero Supply Mfg. Co. B.	18½	17⅛	17
**Aeronautical Ind. Inc.	19⅜	17⅞	19
**Aero Underwriters Corp.	48½	36½	36
**Alexander Industries	13¾	16½	13½
**Aviation Corporation of the Americas	89⅞	58⅞	64⅞
**Aviation Corporation	23¼	17⅝	16
**Aviation Credit Corp.	23¾	17	17
**Aviation Securities Corp.	49¾	43	40
**Bellanca Aircraft Corp. of America	24	17¼	15⅛
**E. W. Bliss Co.	57⅞	46½	54⅞
**Consolidated Aircraft Corp.	44⅝	36	35½
**Consolidated Instrument Company	35	27	18⅝
**Curtiss Aero Export	52⅞	37½	37
**Curtiss Flying Service, Inc.	29¾	23⅜	22⅞
**Curtiss Airports	13¼	11	11⅜
**Curtiss Reid Aircraft, Ltd., Pfd.	35	29¾	29½
**Curtiss-Wright Corp.	30½	....	29¾
**Dayton Aero. & Engine Co.	19⅞	15½	19⅞
**De Haviland Aircraft Corp., Ltd.	10¼	9¼	8½
**Douglas Aircraft Co., Inc.	45½	36⅞	36¾
**Fairchild Aviation Corp.	34⅞	23⅝	15
**Fokker Aircraft Corp. of America	67½	49⅛	46½
**Handley-Page	5¾	5	5⅛
**Irving Air Shute Co.	41¾	31½	34⅞
**Keystone Aircraft Corp.	50	40	45½
**National Aviation	88	65½	69⅛
**Standard Steel Propeller	34⅞	26	34⅞
**North American Aviation	19½	17½	16
**Sikorsky Aviation Corp.	63⅞	47	51⅞
**Thompson Products Corp.	69¾	60⅞	53
**Transcontinental Air Transport	33⅝	27¾	24½
**Travelair	61	50	47⅞
**Universal Aviation	27⅜	17	13
**Western Air Express Corp.	78¼	69⅛	66⅞

*New York Stock Exchange. **New York Curb Exchange.

From the Publisher's Quill

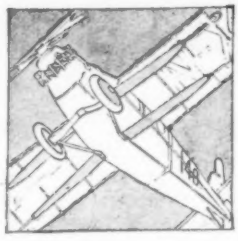
(Continued from page 9)

"In looking over your magazine one is impressed with the large amount of activities in establishment and development of fixed lines and routes from city to city in our country.

"It seems to me if Congress should pass a law providing that when one responsible company has established a line from city A to city B, so long as such company maintains adequate service, a second company should not be permitted to compete with company No. 1. This should encourage the establishment of many routes because the investment would thereby be protected, and the service likewise regulated. Only when public convenience and necessity require a second company as found through such agency as the Interstate Commerce Commission, should a second company be permitted to operate.

"Would like to have your opinion as to advisability of such a federal law applicable to aeronautics."

We have given our ideas on this matter to this sincere and constructive-minded lawmaker. We would be much interested in the opinions of our readers who have thought on this subject. This is a matter of the utmost importance to the entire future of the industry, and the ideas of our readers along these lines would be valuable at this time.



Successful Flight from Old Orchard to Rome

Accomplished with

Longines

Watches, Chronometers and Chronographs Exclusively!

The Pathfinder plane, piloted by Capt. Yancey and Rogers Q. Williams, that made the flight from Old Orchard to Rome was equipped with Longines watches, chronometers and chronographs exclusively. Capt. Yancey is an authority on navigation and thinks that the Longines instruments are the best to be found for accuracy and dependability the world over. As soon as the American flyers reached Rome they cabled us the following: "LONGINES WATCHES & CHRONOMETERS WORKED PERFECTLY ALL THE WAY." All the greatest scientific flights all over the world were made with Longines timepieces exclusively.

A. Wittnauer Co.

Est. 1866

402-404 Fifth Ave.

New York
Chicago
Montreal
Geneva

Classified Advertising

DEALERS

FORTUNE IN AIRPLANE SALES—Under this plan a salesman should sell at least one Eaglerock a month—a net monthly income for him of from $1,000 to $1,500. Our two weeks free sales training course makes you ready to get the money. We equip salesmen who qualify with a free demonstrator Eaglerock. You can offer buyers an easy plan of time purchase. Write for details. Alexander Aircraft Co., Dept. 19, Colorado Springs, Colo.

WANTED

WANT TO BUY—crack-up planes and motors, or second hands, also parts. Braley School of Flying, Wichita, Kansas.

FOR SALE

FOR SALE—Curtiss OX5 motors, pulled from U. S. air service planes for 60-hour overhaul @ $450. These motors completely overhauled, guaranteed to turn up and perform like new, $650. Also one brand new Anzani 120 h.p. motor $550. One brand new 80 h.p. Anzani, $400. One Anzani run 40 hours $250. American Eagle Aircraft Corporation, Fairfax Airport, Kansas City, Kans.

AIRPORT FOR SALE — Well equipped field located one mile south of Ames, Iowa, and Iowa State College, on the busiest road in the state. New pavement opening August 15. Steel hangar. Electric lights. Runways graded, rolled, and seeded. Gas pumps in position. Parking space for cars. Excellent opportunity for student training, passenger work, sales and service. Write for details, Joe V. Gerbrach, Ames Theatre Co., Ames, Iowa.

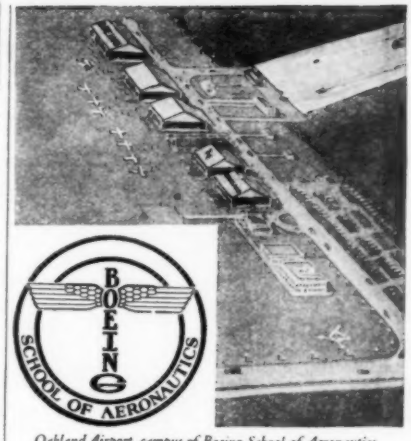
CLUBS

FLYING CLUBS—Are you interested in organizing a flying club? The Marshall Flying Association wants you as a member and will tell you how to secure the money and start your club. Wings and membership card for all members. Address Marshall Flying Association, % Marshall Flying School, Dept. 116, Marshall, Mo.

MODELS

2c POSTAGE STAMP—Brings you complete Model Airplane Supplies Price List. A. A. C. Model Aircrafters; 340 East 188th Street, New York.

MODEL AIRPLANES—and Supplies at Lowest Prices. Send stamp for circular. F. B. MODEL AIRPLANE CO. 1627 St. Johns Place, Brooklyn, N. Y.



Oakland Airport, campus of Boeing School of Aeronautics. Ideal year-round conditions

BOEING SCHOOL of AERONAUTICS

First University of the Air

HERE is the First University of the Air—a school for the man who wants not only instruction in flying, but who wishes to fit himself for a career in this rapidly expanding industry, including executive responsibilities. Aviation, like every other business, is becoming a matter of organization and management. ***At Boeing School, courses never offered before, or given only in a comprehensive way in universities, will be included in the curriculum.***

A Remarkable Backing!

The Boeing Airplane Company made planes that Boeing pilots flew on Boeing routes to establish a performance record in commercial flight of 5¾ million miles in two years. Boeing affiliated plants made the propellers, and engines, too. ***And now Boeing School makes it possible for you to get superior training, both ground school and flying, with a background like this!*** Examination and rating by Dept. of Commerce applied for.

Get complete information on the Boeing School of Aeronautics, which offers various courses, ranging from private pilot course to Boeing master ground and flying courses. ***Send the coupon, or write, NOW.***

BOEING SCHOOL of AERONAUTICS

Division of United Aircraft and Transport Corporation

Airport, Oakland, California

— Coupon for Information —

BOEING SCHOOL OF AERONAUTICS,
Dept. F, Airport, Oakland, California.

I am interested in the Boeing School of Aeronautics course I have checked:

☐ Private Pilot
25 hrs. ground school. In air, 10 hrs. dual, 8 solo.

☐ Transport Pilot
100 hrs. ground school. In air, 50 hrs. dual, 150 solo.

☐ Master Ground School
Includes university subjects. 864 hrs., 18 subjects.

☐ Limited Commercial
51 hrs. ground school. In air, 15 hrs. dual, 35 solo.

☐ Master Pilot
Big plane flying. Open to transport license holders.

☐ Master Mechanic
Training for manufacturing. Twenty-two subjects.

Name.....

Address.....

Directory

Buyers' Service

Prospective purchasers of planes, accessories or other equipment may obtain from AERONAUTICS advice and information concerning all products now on the market. Data on the performance, price and specifications of planes may be had for the asking if you are planning to become an owner. Accurate and specific attention will be paid to all inquiries addressed to "AERONAUTICS Buyers' Service."

$8.50 per lesson **LEARN TO FLY** at our New Airport Nearest to New York City $8.50 per lesson

JAMAICA SEA AIRPORT
Rockaway and Springfield Blvds.
Laurelton 0750 JAMAICA, N.Y.

FLY—Los Angeles to El Paso
via Phoenix, Tucson, and Douglas
on Standard Airliners. Luxurious transportation in De Luxe Super-Trimotor F-10 Fokkers.
WRITE OR WIRE
STANDARD AIRLINES, INC.
107 W. 9th St., Los Angeles

The Aircraft Supply House
What do you need—JN & Canuck parts—OX5 & OXX6 spares, or general utility supplies? If so, you need look no further—you have it. Most complete line in the country. Send for 1929 catalogue No. 7. It is a revelation. Prices low.
MONUMENTAL AIRCRAFT, INC.
SPECIAL SERVICE IN REPAIRING OX5 ENGINE CYLINDERS
1435 EQUITABLE BUILDING, BALTIMORE, MD.

Eagle Airport School of Aviation
HINCKLEY, ILL.
60 miles West of Chicago
Complete training either by the hour or course. Distributors for the Air-King, Exclusive Agency Northern Illinois, Southern Wisconsin and State of Iowa. Agency for Stinson Monoplanes and Monocoupes. Examination and rating by the Department of Commerce applied for. Write for information.

AIRPLANE SPRUCE
Large assortment of kiln dried Spruce, graded in accordance with U. S. Specifications by Pacific Lumber Inspection Bureau. Write for prices on one piece or a carload.
FRANK PAXTON LUMBER CO.
65 Kansas Ave., KANSAS CITY, KANSAS

Flying Instruction for Private or Limited Commercial Pilots' licenses. Preliminary instruction in Wright J6 Challengers.

Sales agents for Fairchild, Challenger and Stearman planes. Also for Fairchild Aerial Surveys. Used planes bought or sold on brokerage basis.

Westchester County's only airport. Operated under Dept. of Commerce regulations. Planes to rent for short or long trips. Planes and pilots licensed.

Westchester Airport Corp. (Barrett Airways), Armonk, N. Y. New York City office, Chanin Building, Tel. Caledonia 6188.

Westchester Airport

ILLUSTRIERTE
FLUG-WOCHE
Periodical for Furthering Air Travel in the Service of Business and International Traffic
Air Travel-Engineering Air Travel-Business
Air Travel-Policy
Appears Monthly Annual Subscription Price Mark 28.00
VERLAG FUER DEUTSCHES FLUGWESEN
Berlin-Lichterfelde, Augustastrasse 18, Germany

We Build Everything for the Airplane
Steel Fuselages, landing gears, tail surfaces, wings, gasoline tanks, etc., built to specifications. Complete Departments in every branch. Prices and Service attractive.
Revelation Aircraft Co., 225 W. 57th St., New York City

AERONAUTICA
MONTHLY INTERNATIONAL ILLUSTRATED REVIEW
Medium of Flying and Aeronautical Construction of Italy
Whatever is of interest in aerial navigation, one may read in this periodical, one of the most valuable and most widely circulated of the aeronautical publications.
Subscription: one year 100 lires Sample copy 10 lires
AERONAUTICA, VIA GESU, No. 6. MILAN (ITALIE)

A National Air Academy

By Senator Henry S. Allen

U. S. Senator From Kansas

SPEED and efficiency are constant demands of our modern civilization. Leaders of industry and commerce are looking to air transportation, the fastest means ever devised by man, as one of the logical answers to these demands in the future.

At the same time, military men are considering airways in the light of plans for the national defense. The art of flying is becoming so highly developed that, in case of war, the major theater of action might be transferred to the air.

The well considered suggestion of Mr. William B. Ziff, publisher of AERONAUTICS magazine and a close student of the problems of aviation, that the Federal government should establish a National Air College, is both timely and significant.

Such a college would build up a fine personnel of well-trained aviators, just as the United States Military Academy at West Point and the United States Naval Academy at Annapolis now are training some of the finest young men of our country for service as army and navy officers. It would offer new opportunities to thousands of young men who have their hearts set on entering the field of aviation, but who now are kept out by the lack of facilities.

By working in cooperation with the Federal departments of War, Navy, and Commerce, a National Air College would be a powerful factor in stimulating further public interest in aviation.

I believe that Wichita, Kansas, christened "The Air Capital," by us who live there, would be an ideal location for the National Air College. Wichita is situated near the geographical center of the United States. Here, the Government would have the advantage of relatively cheap land for buildings and airports, compared with some of the industrial centers of the East and far West. Airport facilities already are provided by eight flying fields, five of them strictly factory properties, embracing a total of nearly 1,600 acres. The Wichita Municipal Airport, now being developed, is a tract of 640 acres of virgin soil.

In the vicinity of Wichita, flying conditions and visibility are good throughout the year. There is much level farm land over the surrounding country, a factor of safety for student aviators faced with the possibility of forced landings.

Wichita's air industries, unexcelled for diversity and concentration by those of any other city in the United States, would offer valuable laboratories for students in a Federal flying school. The country's first commercial airplane factory was established in Wichita about ten years ago. This year, six airplane factories will produce some 2,500 planes. Six more producers are in the experimental stage, and six are being organized. A million dollars' worth of construction in Wichita's aeronautical industry is now under way.

The citizens of Wichita, confident in the future expansion of the airplane industry in this middle western city of 115,000, earnestly desire the establishment of a National Air College. They believe a careful study of the situation would result in the establishment at Wichita, and they are ready to respond to the opportunities for national service which such an institution would bring.

What Is the Law?

(Continued from page 19)

magazine in their actual experience, or arise as speculative problems in the minds of aeronautical thinkers or students. Queries on subjects of aeronautical law should be addressed to Legal Interpretation Dept., AERONAUTICS, with self-addressed and stamped envelope. Where reply by wire is sought in pressing matters so state. Otherwise your mail will bring you your reply—or watch this magazine. Some of the questions will be answered in these pages.

This department is open, not only to the laity, but also to lawyers, legislators, and city law-makers as well.

State legislators interested in uniform legislation may take advantage of this department of AERONAUTICS. Attorneys are welcome to use this service in any way and references to American and European decisions covering points in aeronautical law will be given. Officials of municipalities are free to consult AERONAUTICS to obtain the latest information of a legal nature pertaining to aviation activities as they affect cities.

Operators, private owners, pilots and all others are to feel free to ask any questions of a legal nature and to make full use of this service.

LEARN to FLY

At a CURTISS SCHOOL

The new Curtiss course is now ready. It was prepared for you by civil and military experts. It is standard at each of the 35 Curtiss schools. It is conducted solely by instructors who have taken the special Curtiss Instructors' Course.
In this splendid modern course only the finest equipment is used—including the highest priced training planes.
Avail yourself of this first-class training and properly prepare for a high place, in the fascinating business of aviation.

Flying school courses for those seeking private, commercial or transport flying licenses. Ground school courses given with all flying courses are also offered separately. Those over 16 are invited to write for information.

CURTISS FLYING SERVICE

"World's Oldest Flying Organization"

27 WEST 57TH STREET
NEW YORK CITY

Examination and Rating by the Dept. of Commerce applied for.

FLY WITH US

Our first airplane, three place bi-plane, built by the club, is out flying. Work has started on the second club ship, a two place cabin monoplane. Our method of training and our plan of building are of great advantage to our members.
Members are now receiving instruction in their own plane. Dual instruction $10 an hour. Solo $5 an hour.

Only a limited amount of Life Memberships open.

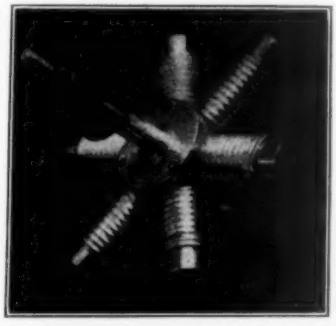
EDGEWATER FLYING CLUB, Inc.

Office:
3410 Montrose Ave.
Chicago, Illinois.

Flying Field
Cook County Airport
8700 Irving Pk. Blvd.

Compressed Air Motors

6 CYLINDER "SPEEDAIR CHALLENGER"



Build a model plane and use this finest 6 cylinder model aero motor. Will turn 17" prop. 1200 R.P.M. and run for 1 minute on our tank. Flies 4½ to 6 foot models. We sell 5 foot Lockheed-Vega motor model—also 24" wingspread CurtissHawk rubber driven. Motors $16.50 each.
Send 10c coin for illustrated catalog.

MINIATURE AIRCRAFT CORP.
83 Low Terrace New Brighton, N. Y.

Authentic Airway Information
ON ALL AIR LINES
PASSENGER—MAIL—EXPRESS

Schedules Equipment
Rates Offices
Maps Officials

Published Monthly

The OFFICIAL AVIATION GUIDE
105 W. Adams St. Dept. A Chicago, Ill.
$5 per year *single copies 50c*

WASHINGTON'S AVIATION HEADQUARTERS

Clubrooms for Exclusive Use of Aviators.

Special Aeronautical Rates.

CARLTON HOTEL

16th and K Sts., Washington, D. C.

CLEM W. GERSON, Manager

YOUR MONEY BACK

If you don't find Selley Champion Kits perfect in design, simple to build and of fine flying qualities.

Actual Photograph Columbia Model — 30 in. wing spread. Built from Selley Champion Kit.

Send for any of these Selley Champion (Semi-Constructed) Model Airplane Kits—designed by "Selley," famous flyer of Model airplanes. If you're not entirely satisfied, send it back—*your money will be immediately refunded.*

Curtis Ace $4.25 Columbia . . $6.75
Bremen . $6.25 Spirit of St. Louis $7.25
Stinson Detroiter Bi-plane $7.75

(15c additional west of Rockies)

Complete catalogue of Champion Model Airplanes, Parts and Supplies Sent for 5c.

A. F. SELLEY MFG. CO.
1405 Gates Avenue, Brooklyn, N. Y.

Panama Is Defenseless

By Gen. William Mitchell

(Continued from page 14)

tain a victory in war with alarming suddenness.

In planning the defenses of the Panama Canal, let us bear in mind that we must not sit on the Canal with our aircraft and try to hatch it. We must get off on the fringe of islands that stretch from Florida to South America and there conduct an air defense. Porto Rico and the Virgin Islands are the central positions for the defense of the Canal from the Atlantic side, as they are almost equidistant from Florida, the Canal and the coast of South America.

It is true that submarines could pierce this curtain of islands by keeping under the water as they came through the gaps between, and they could come up within air torpedo range of the Canal and probably hit it; but in the Caribbean Sea, with its clear water, defending submarines, together with aircraft, particularly dirigibles carrying airplanes, could prevent a serious attack. Airplanes can land and take off from dirigible airships with ease. Airships make the best carriers for airplanes, much better than a sea ship and more economical to build and operate. An airship can launch all its airplanes at once, 15 or 20 of them, and immediately develop its full air power. A sea ship has to launch them a very few at a time. A seaship carrier matched against an airship carrier would be defeated at once.

On the Pacific side, we find several islands that could be occupied and used as aircraft bases for operations against the Canal. Cocos Island and Malpelo Island, or the whole group of the large Galapagos Islands which are about the same distance from the Panama Canal as is Porto Rico, something like 950 miles would serve nicely. The Galapagos Islands are extremely important as they control the Pacific approaches to Panama. They belong to the Republic of Ecuador in South America. A defense of the Panama Canal on the Pacific Coast could well center on these islands.

We need only about 2,400 airplanes in our front line air force to defend this country against any foreign attack that can be launched against us, practically the cost of two battleships. The airways which these would use, the men who would fly them, the mechanics who would keep them up, can almost all be used in time of peace for some commercial purpose and not be a drain on the government such as exaggerated navies are. But we have no real air force in the United States.

What a preposterous thing it is for the Army to keep people thinking that we should line our coasts with great fixed cannon that sling pumpkins out in the water for the purpose of hitting battleships that may come over and attack our coasts. These fellows hope and presume that in case of war, a battleship will come and sit out there in the water in broad daylight and allow itself to be hit. Of course no such thing will occur, but an attack will come through the air, and these monster cannon, a relic of a bygone day, will be practically useless. Each time we emplace one of these large seacoast cannon, it costs us a half million dollars.

The Navy tries to make us believe that surface fleets will still be used in war; otherwise they would have to get out of the surface ships and into submarines. They don't like submarines because these are constricted in their area, the beds are uncomfortable, the air is bad and one cannot smoke and have a good time; but they are the only effective weapon left in the sea, so greatly has the influence of aviation modified the principles of national defense.

When we see our poor misguided country still leaving the development of aviation in the hands of the Army and Navy, we can appreciate how utterly helpless we may be in case of a national emergency, if we have to face one of the great air powers of the world, such as Russia, Germany, England, France, Spain, Italy or Japan.

Know Flying

Table of Contents

CHAPTER ONE
Airfoils, Lift and Drag

CHAPTER TWO
Control

CHAPTER THREE
Inherent Stability

CHAPTER FOUR
Interesting Points in Design

CHAPTER FIVE
Construction of Airplanes

CHAPTER SIX
Practical Flying—
The Slotted Wing

CHAPTER SEVEN
The Weather and Aviation

CHAPTER EIGHT
Airports—Airways—Safety

CHAPTER NINE
Pilot Licenses—The First Lesson

CONCLUSION—Terminology.

Used by 20 Flying Schools in all parts of the United States and Canada as a plain English text-book. Here's a typical letter:

"Your book 'The Modern Airplane' was chosen by the faculty of this school for a text book from a representative collection of books regardless of their price. We highly recommend this book to anyone interested in aviation."

R. V. TRADER, Mgr.
Pittsburgh School of Aviation.

— — — — — — USE THIS COUPON — — — — — —

ROTH-DOWNS AIRWAYS, Inc.
2510 University Ave.,
Saint Paul, Minn.

Here's my dollar. Rush me postpaid a copy of "The Modern Airplane."

Name (Print) .....

Address .....

The outstanding goggle of 1929

The new improved

SEESALL

created by the makers of LAMOGLAS "Eyes for the Skies"

REFINEMENT in details of frame construction and finish, including a hinge front, make this new Seesall the most attractive as well as the most comfortable and widest vision goggle for flyers . . . Price with clear bent cylindrical ground and polished lenses $15.00. With tinted lenses $17.00.

• • •

SOLD by dealers everywhere—but if more convenient—send us your check for $15.00 ($17.00 if tinted lenses are desired) and we'll send you your improved Seesall by return mail. If not satisfied with your purchase you may return it and money will be cheerfully refunded.

WHOLESALE orders, west of the Rockies, filled from stock by R. Mohr & Sons, Mohr Building, San Francisco, Calif. In Canada: Ericson Aircraft Ltd., 45 Jarvis St., Toronto.

WRITE FOR CATALOG OF GOGGLES AND FLYERS' APPAREL

BECK

BECK DISTRIBUTING CORP. 66 EAST 131st ST., NEW YORK

Every Thing You Desire in a Hotel

Every possible comfort, food famous for its excellence, a soul-refreshing sense of relaxation—these you will enjoy at THE DRAKE. But when you wish theatres, shops, the myriad day and night activities of this great city, a few minutes' interesting walk will take you to the heart of Chicago's busy Loop. A truly remarkable combination in a great city hotel. Rates as low as five dollars a day single room with bath, six dollars double. Special discounts for extended stays. Write for Illustrated Booklet, Edition 3.

The **DRAKE** **HOTEL** *Chicago*

THE DRAKE *is under the Blackstone management, the world's standard in hotel service*

PATENTS
TRADE-MARKS

SERVICE

Without charge or obligation, we will inform you on any questions you may put to us touching on patent, trade-mark and copyright law. You may ask: "Should I protect myself by patent, or register under the trade-mark or copyright laws? What kind of a patent should I obtain?" and many other questions that may occur to you. These are vital points to consider and questions will be cheerfully answered.

Evidence of Conception

Before disclosing your invention to anyone send for blank form "EVIDENCE OF CONCEPTION" to be signed and witnessed. As registered patent attorneys we represent hundreds of inventors all over the United States and Canada in the advancement of inventions. The form "Evidence of Conception," sample, instructions relating to obtaining of patents and schedule of fees sent upon request.

LANCASTER & ALLWINE
471 Ouray Building
Washington, D. C.
Originators of forms, "Evidence of Conception."

Aviation Stocks in Greater Favor

(Continued from page 31)

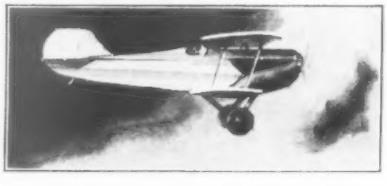
tion, considered the "bugaboo" of early summer, has been forgotten by traders, but it is still with us. The Federal Reserve Board has apparently relaxed its tight money policy to some extent to help finance the seasonal increase in business needs for autumn trade, but high interest rates still constitute the greatest brake on business prosperity as well as the stock market.

From a fundamental standpoint it appears that most boomed stocks are still selling too high. Their purchase is, therefore, not advisable from a true investment standpoint. On the other hand, the general market may continue to advance still further, and at even increasing pace, until the breaking point is finally reached.

The only basis upon which purchase of stocks is justified at this time is for speculation, but from that angle there seems to be many issues which could produce attractive additional profits for their holders. The advance of the general market has been so rapid that sharp reactions must be expected, if they have not already materialized by the time these lines reach readers. It hardly seems probable, however, that such early shake-outs will be very long-sustained and such sharp dips may merely offer opportunities for picking up the best and strongest issues for a speculative and short-term play.

Thus far in the new upward movement the aviation stocks appear to have lagged somewhat behind the leading groups, due perhaps to the rapidity of previous run-ups earlier in 1929 and last year. It seems reasonable to assume, however, that if general market conditions continue satisfactory, the air group of securities will come in for more spectacular gains before the speculative fever of the public is finally quenched.

We have previously called attention to the possibilities of a depression in the aviation industry which is called for by past history and economic theory. With most aviation stocks already selling at high levels, they should not be touched except for speculation. From such a standpoint, however, such concerns as Wright Aeronautical, Curtiss Airplane, Fokker, Bendix and United Aircraft have unquestioned possibilties. In the transportation field such concerns as T. A. T., Western Air Express and Universal seem in good position.



Airing Armament Secrets

(Continued from page 30)

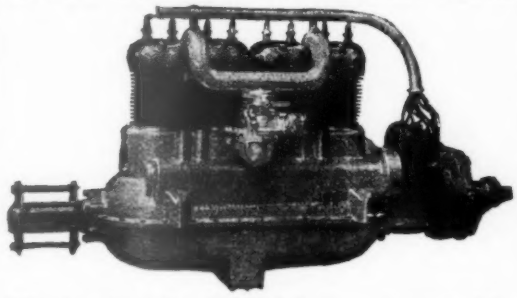
One of the best of the more recent exemplifications of the growing American policy to dispense with secrecy was the landing of the airship Los Angeles on the aircraft carrier Saratoga, and the immediate publication of its details. It is likely that England would have found a quiet spot on the North Sea for this experiment, and there would have been no statement afterward from the officials such as Admiral Moffett's statement reporting the Los Angeles experiment. But there are signs too that the British have given up the business of "mystery aircraft," having learned that the only mystery concerning them was the reason for their mysteriousness.

The aviation of the future can have no more privacy than Irvin Cobb's goldfish.

For Lighter 'planes . . . the

CAMERON

SIXTY HORSEPOWER 4-IN-LINE



Eliminating the difficulties encountered in adapting radial engines to lighter planes ... where stream-lining is the most vital factor ... this new straight-line engine gives more power in proportion to weight and displacement than any power-plant in its horse-power class.

A DESCRIPTIVE FOLDER WILL BE MAILED ON REQUEST

National Aero Corporation

100 East 42nd St. *Sales Offices* New York City

FLIGHTS INTERSTATE, INC.

FLIGHTS INTERSTATE, INC., are pioneer operators of a daily Asbury Park-New York City air-line route, offering to the air-minded traveler of the Metropolitan area the speed, cleanliness and convenience of air travel in famous Bellanca cabin planes, powered by the Wright Whirlwind Motors, flown by finest type transport pilots.

The company has available fast biplanes and monoplanes, motored with Whirlwind Motors, for hire to those desirous of rapid transportation to any point. Charter of these ships may be arranged at Company Offices, 551 Fifth Avenue, or leading hotels in New York.

AIR TRAVEL BUREAU

Central Booking and Information Bureau for All Air Lines

Telephone Murray Hill { 5785 / 5786

At our New York Executive Offices, we maintain an Air Travel Bureau, where information regarding Air Travel throughout the United States and Europe may be secured and bookings arranged for any point, with a minimum of inconvenience to the Traveler.

We invite the Traveling Public to use this Bureau at any time. There is no charge for the service. Telephone Murray Hill 5785-5786 and ask for Miss Shaw.

TRAVEL THE MODERN WAY — THE AIR WAY!

FLIGHTS INTERSTATE, Inc.

551 Fifth Avenue New York City

Telephone Murray Hill { 5785 / 5786

Airplane Transportation
Sightseeing Airplanes
Charter Ships Anytime Anywhere

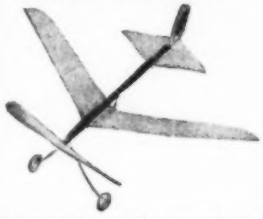
SWIFT, SAFE, COMFORTABLE TRAVEL
for PLEASURE for BUSINESS

BROADFIELD

FAMOUS FOR FLIGHTS **Model Aeroplane** QUICKER EASIER BETTER ASSEMBLY

CONSTRUCTION KITS

BROADFIELD
Giant Chic-A-Dee
NO. 2 R. O. G.



HERE is a model plane of bird-like beauty that gives unsurpassed performance. Made record flight of 7 minutes, 15 seconds. Sweep back wings insure stability. May be flown indoors or outdoors. All die-cut parts of balsa wood. All wire parts formed. Unbreakable 9" bent wood balsa propeller.

The Giant Chic-A-Dee gives amazing performance. Created sensation at recent contest in Detroit. Possessing all ultra-modern construction features, it is truly a prize-winner in duration flights. Complete construction kit, which may be assembled in two hours, is sent direct for $1.00. Big, new Catalogue sent FREE with order. **No. 2 Kit, $1.00**

BROADFIELD
CHIC-A-DEE NO. 1 R. O. G.

HERE is a smaller model plane that possesses all the finer features of the Giant Chic-A-Dee. Gives beautiful performance both indoors and outdoors. It has unbreakable bent wood propeller and sweepback main wing. Complete construction kit, with directions, assures perfect and quick assembly. Complete kit at 50c includes big FREE Catalogue. **No. 1 Kit, 50c**

"APPEARANCE PLUS PERFORMANCE"

TIGER MOTH
R. O. G.

TIGER MOTH is truly the aristocrat of the air. Exquisite in line and giving beautiful performance, it is the last word in model plane perfection. Weighs but 1½ oz. assembled. Fuselage measures 17¾"—main wing 26"—propeller 9". Main features are the removable propeller and motor stick and the adjustable wing and stabilizer. Complete construction kit includes die-cut balsa parts, formed wire parts, sweepback wings, cabin, cement, "Airtite" Covering, color dyes, winder, etc. Tiger Moth Kit is sent direct for $3.75. New Broadfield Catalogue sent FREE with order. Check proper squares in coupon and mail today. **No. 200 Kit, $3.75**

Catalogue Sent Separately for 10c

If your dealer does not carry Broadfield Models—Send your order direct

BROADFIELD AEROPLANE CO., Dept. 19.
Hempstead, L. I., N. Y.

☐ I am enclosing $1.00. Please send me the Giant Chic-A-Dee Complete Construction Kit together with your new Catalogue.

☐ I am enclosing 50c. Please send me the Chic-A-Dee No. 1 Complete Construction Set. Also your new Catalogue.

☐ I am enclosing $3.75. Please send me the Tiger Moth Complete Construction Kit and the new Catalogue.

Name .....

Address .....

City ..... *State* .....

The Flying Movies

(Continued from page 22)

low that his cockpit apparently was empty. A second wing mount was hung from the upper wing spars, quite close to the cockpits. This set-up gave "big heads" of the occupants of both cockpits or of either cockpit, depending upon just how the camera was pointed and the lens used. In all these shots effort was made to show the horizon and the ground moving below in order to show definitely that actual flying was taking place. One such shot required the instructor to drop the controls, turn, kneel in his seat, and sock his student who had supposedly frozen to the stick, with a Pyrene fire extinguisher,—all at four hundred feet altitude. The instructor's frantic dive for the stick as soon as this action was completed invariably showed up on the uncut film and caused many a laugh when looking at the "rushes"—and some anxiety as to whether we hadn't better get it on the ground.

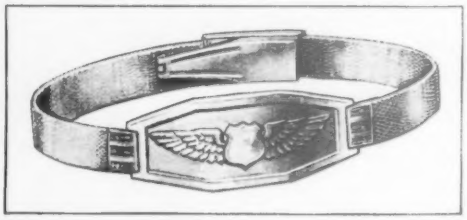
At Pensacola the planes were painted to match the NY-2s that we had used at San Diego, and all shots made were sufficiently long so that faces could not be identified. Many automatic camera shots with the saddle mounts were also made at Pensacola, the pilot, Lieutenant Walker, USMC, sidestepping water tanks and lookout towers with ease and dexterity, yet coming so close to them that everyone breathed a sigh of relief when his hop was finally over. A cameraman rode with him on most of these shots, as we were too far away from the studio, where all film is developed, to get the rushes sent back to us, and hence we wanted a cameraman's opinion as to what scenes were actually "in the can."

In one scene in the picture a student stalls, falls in a tailspin, crashes, and his plane burns. This was actually made as follows: First, a shot of the plane climbing into a stall and starting to drop into a spin made from a camera-plane at Pensacola; second, close shot of the student showing his terror-stricken face and the ground below him swirling as he spins, made in a tailspin with a wing mount at San Diego; third, shot of the plane as it spins downward, made by sideslipping the camera plane close alongside the spinning plane for some 1500 feet with Pensacola unmistakably in the background; fourth, the plane crashes, made in miniature in a tank at Culver City; fifth, the plane burns, made by actually burning wreckage at Pensacola. The way these various shots matched and blended, giving the impression of a single almost instantaneous happening, is almost uncanny.

In *The Flying Fleet* all crashes were made in miniature because we did not consider it worth while to risk human lives by having stunt men actually do them considering the slight improvement in the photography thus obtainable, and stunt men work notoriously cheap.

The final sequences of the picture showed searching planes working off the carrier Langley and the attempted San Diego-Honolulu hop of a T-2-D seaplane. The carrier work was shot in the ordinary manner, using the methods outlined above. The T-2-D flight was photographed as follows. First, departure from San Diego and day shots in the air, actually photographed in flight; second, night shots of the T-2-D in flight in the storm and finally crashing in the Pacific, made in miniature at the studio; third, men crawling up onto the top wing of the crash as waves break over them, made on full size false wing in the tank at the studio; fourth, day shots of crew on top wing, suffering from thirst, and sun, made on floating wing off the end of the Del Rey Pier. These latter shots were made during a continual battle with the surf which delighted in washing actors and director and cameraman overboard just as they were ready for a scene, fog that frequently made shooting impossible because of poor light even with such artificial lights as could be rigged, but which gave the company a chance to do a little serious fishing, and seagulls that apparently had an insane desire to enter the movies. The beards grown and the cracked, sunburnt lips acquired by the members of the crew of the T-2-D needed no make-up,—nature took care of that.

Films featuring aviation have been produced that pretty well cover the Army, the Navy, the late war, barnstorming, training, the Air Mail, etc. *Hell's Angels*, an epic of the war birds, has been in production almost two years and is said to be more than two million dollars "in the red" with the date of its premiere yet to be definitely announced. Yet it is certain that aviation will continue to play a growing part in pictures, just as it continues to play a greater and greater part in our national life.



DE LUXE

WRISTAG

"The Identification of Aviation"

Worn by Pilots, Students, and all others allied with the interests of Aviation.

ABOVE MODEL, SILVER TAG, WHITE METAL MESH BAND, $5.00

Write for circular showing other patterns

PARKER & COMPANY

Manufacturers of Aviation Pins, Emblems, Identification Wristlets

616-18 ARCADE BLDG. ST. LOUIS, MO.

HOTEL MANGER

SEVENTH AVENUE 50th-51st STREETS

NEW YORK CITY

"The Wonder Hotel of New York" ***"A Modern Marble Palace"***

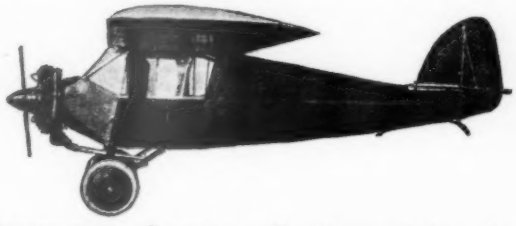
This beautiful hotel, with its splendidly furnished sleeping rooms and distinctive public rooms of the colorful Spanish Renaissance period, affords the traveler a most restful background. In the very centre of town Hotel Manger offers the unusual advantage of easy accessibility, select accommodations amid a quiet, dignified atmosphere.

Rooms with running water *(for one)* $2.50 *(for two)* $3.50

Rooms with shower or bath and shower *(for one)* $3.00-5.00 *(for two)* $4.00-6.00

Parlor, bedroom and bath $10.00-12.00 NO HIGHER RATES

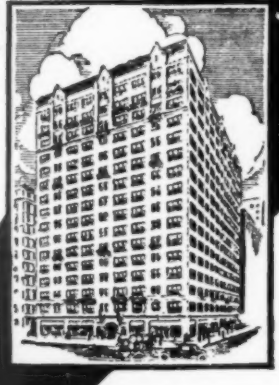
☆ ONLY
CAVALIER
OFFERS SUCH UNUSUAL
PERFORMANCE
WITH COMFORT AND ECONOMY



Greatest speed range... finest appointments and construction... and now available for delivery... See the nearest dealer or write for complete information.

Star Aircraft Co.
BARTLESVILLE, OKLAHOMA

McCormick Hotel
CHICAGO



Just a ten-minute walk from the loop—close to everything. Modern and up-to-date in every respect.

No parking restrictions. Excellent garage service.

200 hotel rooms—all with private bath. 300 kitchenette apartments—1 and 2 rooms.

Rates: Hotel rooms, $2.50 to $5.00, single.

Apartments, $28.00 per week and up (two people).

Dining-Room in Connection

HOTEL McCORMICK
Rush at Ontario CHICAGO, ILL.

"How can I get.. into Aviation?"

Read this Answer from

A World Famous Trans-Atlantic Pilot

Walter Hinton was pilot of the famous NC-4, first plane to fly the Atlantic. He piloted the first plane from North to South America. He was first to fly to the headwaters of the Amazon. And Hinton also has the rare ability to teach *others* the knowledge he has gained. During the War he was a crack flying instructor for the Navy. Today—with a course that experts agree is the most complete and practical ever produced—Hinton is training far-sighted men for the Big-Pay jobs in Aviation.

You Must Be Serious

To take an active part in Commercial Aviation you should be at least 18 years of age. If you are under 18, please do not ask for Lieut. Hinton's Book because it will not help you.

AVIATION is waiting for no one! Landing fields, plane and equipment factories, air lines, service and sales organizations—all are leaping ahead in the most amazing development any industry has ever known. In such racing, feverish activity, *where* is there any room for a man who has nothing to offer? An empty pocketbook is no drawback—but Aviation has no place, no patience, no *time* for empty hands or empty heads! Aviation is taking-off for the greatest non-stop flight in history—and the men who will go along and climb to the top are the men with a foundation of FACTS under them.

You Don't Have to Fly; 40 Jobs on the Ground PAY BIG Too!

To succeed in Aviation—make BIG MONEY—you need not necessarily be a pilot. There must be many thousands of pilots, certainly. But for every plane that flies, there's an immediate need for trained men in more than forty different important jobs on the ground. Construction, motor and instrument experts—airport managers, service foremen, salesmen—and more, all make *real* money. But every last one of them must have the FACTS. Today's problem—YOUR problem—is to LEARN Aviation *quick*.

Get Your Ground Work NOW at Home—Hinton Will Train You

You can train at home in spare time. Hinton's proved home-study course gives you all the facts about construction, motors, instruments, theory of flight, navigation, commercial Aviation—facts that every man must have to intelligently and profitably fill ANY job in the industry. Serious-minded—*air-minded*—men are reading and *acting* on "Wings of Opportunity," the Free Book shown below. We want YOU to have a copy too! Send the coupon NOW.

Aviation Institute of U. S. A.
WALTER HINTON, *President*
1115 Connecticut Ave., Washington, D. C.

Mail Now for Facts

Walter Hinton, President 101-Y
Aviation Institute of U. S. A.
1115 Connecticut Av., Washington, D. C.

Please send me at once your FREE Book, "Wings of Opportunity," showing how I can get into this tremendous field.

Name .....

Street ..... Age..... (Must be over 18)

City ..... State.....

Well, Well
What have we here?

None other than a popular impression of little Johnny learning to *Fly* by MAIL! First thing you know he'll have his correspondence school diploma—and then watch out Lindy! If Johnny doesn't hop to Mars it will be Mars' fault entirely . . .

Funny, eh? Oh, very. That is—it *would* be funny if the whole thing weren't so grossly misunderstood. In the first place, Johnny's mail instruction makes no pretense of teaching him to *fly*. In the second place, Johnny is apt to do real things in Aviation. He has the stuff. He's getting the training—good training—in the one way that is practical for him.

Please Understand—

Aviation Institute of U. S. A. is a correspondence institute. I don't "admit" it; I'm proud of it. I do *not* attempt or claim to teach flying. I *do* teach the fundamental facts of Aviation—the essential *ground work*—to men who can't attend an Aviation class-room.

You know that the Industry needs employees who have a *working knowledge of Aviation*. My course is thorough and practical. It successfully gives serious minded men a working knowledge of the theory of flight, aerodynamics, plane design and construction, rigging, repairs, motors, commercial Aviation—basic facts which turn fumbling tinkerers into level-headed *assets* to any employer. These students who then wish to go ahead and learn *flying* are sanely referred to their nearest field, allowed special rates and make good sooner because of my preliminary training.

I'm holding an ace-high hand and I want you to call me. If you'll ante the coupon below I'll see you with my Catalog, describing my whole proposition. I want and expect to win—your confidence and approval. Your play!

Walter Hinton, *President*

Aviation Institute of U. S. A.

1115 Connecticut Ave.
WASHINGTON, D. C.

Mail Now for Facts

WALTER HINTON, Pres., 115-Y
Aviation Institute of U. S. A.,
1115 Connecticut Avenue, Washington, D. C.

Kindly send me a copy of your booklet outlining your home-study, "ground-work" course in Aviation.

Name.....

Street.....

City..... State.....

Index to Advertisers

Aero Model Company 79
Aeronautica 90
Airplane Spruce Co. 77
Airtech Training School ... 90
Alexander Aircraft Co. ..5, 72
American Eagle Aircraft Corp. 43
Aviation Institute of U. S. A. 97, 98

Beck Distributing Corp. ... 93
Becker's 83
Bedford Y. M. C. A. School 77
Berry Brothers 6
Boeing School of Aeronautics 89
Braley School of Flying, Inc. 57
Broadfield Aero Company.. 95

Columbia School of Drafting 88
Command-aire, Inc. 8
Consolidated Air College .. 55
Curtiss Flying Service 50, 51, 91

Eagle Airport School of Aviation 90
Edgewater Flying Club ... 91

Fairchild Aviation Corp. .. 3
Fleischmann Trans. Co. ... 84
Flights Interstate, Inc. 95
Flug-Woche 90

Greer College 76

Hawthorne Model Aero Corp. 83
Norman P. Henley Pub. Co. 66, 73
Hotels:
Carlton 92
Drake 94
McCormick 97
Manger 96

Ideal Aeroplane & Supply.. 83
Independence Model Airplane Co. 88
International Correspondence Schools 85

Jamaica Sea Airport 90
Johnson Co. 77

Lancaster & Allwine 94
Lincoln Airplane School .. 71
Los Angeles Chamber of Commerce 4
Lustberg, Nast & Co. 35

Mann & Benton 77
Marshall Flying School ... 69
Mason, Fenwick & Lawrence 77
Meyer, N. S., Inc. 83
Miniature Aircraft Corp. .. 91
Monumental Aircraft, Inc. . 90

National Aero Corp. 95
National Aviation Training 87
Naturaline Company of America 2
Nicholas-Beazley Airplane Co. 39

O'Brien, Clarence A. 88
Official Aviation Guide 91

Pacific Technical University 86
Parker & Company 96
Parks Air College 53
Frank Paxton Lumber Co. . 90
Peru Model Airplane Shop 83
Pitcairn Aviation, Inc. 61
Polachek, Z. H. 83

Radio Manufacturers' Monthly 82
Revelation Aircraft Co. ... 90
Ronald Press 74
Roth-Downs Airways..... 93

Selley Mfg. Co. 92
Simplex Air Model Company 83
Standard Airlines 90
Star Aircraft Company ... 97

T. A. T. Flying School 70
Texas Pacific Coal & Oil Co. 99
Travel Air Co. 45

Universal Aviation Schools 49

Waco Aircraft Co. 47
Westchester Airport Corp.. 90
Whittelsey Mfg Co. 40, 41
Wittnauer, A. & Co. 89
Wright Aeronautical Corp. 100, 10

Yoho & Hooker Lumber Co. 61

CS

S

94
71

4
35

77
69
77
83
91
90

95
87

2

39

88
91

86
96
53
90
83
61
83

82
90
74
93

92

83
90
97

70
99
45

49

47
90
41
89

10

61

XUM